Vol. 91, No. 11 New York, March 17, 1928 *Pages 541-592*

L. W. W. MORROW Managing Editor
EARL WHITEHORNE Commercial Editor
ALLEN M. PERRY Associate Editor
G. F. WITTIG Statistical Editor
H. M. CAMERON Financial Editor
F. C. WELLS News Editor
EUSTACE C. SOARES Manufacturing and Markets Editor

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

W. H. ONKEN, JR., *Editor*

FRANK R. INNES and T. P. KINDIG Western Editors 7 South Dearborn St., Chicago
H. S. KNOWLTON New England Editor 88 Tremont St., Boston
WALTER C. HESTON Pacific Coast Editor 883 Mission St., San Francisco
E. B. SEARLES Assistant Editor
PAUL WOOTON Washington Correspondent National Press Bldg., Washington

Contents of This Issue

EDITORIALS 541

LINE CONSTRUCTION METHODS USED IN FLORIDA-GEORGIA WORK 544
By M. J. Idail and C. E. Bland

Organization and handling of forces to speed completion of transmission lines and substations involved in expansion of National Public Service Corporation's system.

PORCELAIN BUSHINGS SUPPORT TUBULAR BUS 551

REVERSING DRUM SWITCH TRANSFERS MOTOR CONTROL 551
By C. B. Carpenter

CABLE POTHEAD PROTECTION 552

GENERATOR RATING CLOSE TO 30,000,000 KVA 552

FIELD TESTING OF RELAYS 553
By W. M. Evans and R. J. Salsbury

INDUSTRIAL POWER INTERCHANGE 555
An Interview With T. O. Kennedy

Economical utilization of byproduct power can be worked out jointly by power and manufacturing industries to conserve the energy that is now wasted in many manufacturing plant processes.

TRANSFORMER RADIATOR MOUNTING THAT SAVES SPACE 556

NEW BUFFALO UNIT FEEDS 22-KV. SYSTEM DIRECTLY 557
By Cromwell MacIntosh

SEAPLANE AIDS LINE RIGHT-OF-WAY SURVEY 558

FIVE YEARS OF STOCK DIVIDENDS 559
By Frank L. Dame

Method adopted in 1923 proves beneficial both to shareholder and to the company. Comparison with issue of rights and financial results of the two policies over a period.

SYSTEM ROUTINE IN EMERGENCY SWITCHING 560
By C. P. Hubbard

WHITE-WAY STREET-LIGHTING FIXTURES ON WOOD POLES 561

AUTOMATIC FURNACE PERMITS ACCURATE HEAT CONTROL 561
By W. J. Diederichs

ELECTRIC SIGN MAINTENANCE PLAN INCREASES REVENUE BY $2,000 562

COST OF ELECTRIC COLD STORAGE IN FARM DAIRIES 562

SOME EXPERIENCES IN PRICE CUTTING 563
By Earl Whitehorne

A close-up picture of the present tension in the market. Why the seller and the purchaser are at loggerheads.

WOMEN WORKERS IN SERVICE REPRESENTATIVE PLAN 567
By W. G. Burrill

LETTERS FROM OUR READERS 568

DIGEST OF ELECTRICAL LITERATURE 569

NEWS OF THE INDUSTRY 571

COURT DECISIONS, COMMISSION RULINGS 578
MEN OF THE INDUSTRY 579
FINANCIAL AND STATISTICAL 581
BUSINESS NEWS AND MARKET CONDITIONS 585
NEW EQUIPMENT AVAILABLE 589
ELECTRICAL PATENTS 590

BUSINESS FACTS FOR ELECTRICAL MEN 591

Credit Belongs to Utility Industry

"THE New Year issue of the ELECTRICAL WORLD, which reached our hands last week, is, as usual, of exceptional interest; nowhere else can be found such a wealth of statistical information regarding the electrical industries of a great nation—one which, from the point of view of electrical development, is easily first in the world. The editors utter a timely word of warning with regard to the use of statistics; accurate though these be, they may lead to erroneous deductions if not interpreted with intelligence and understanding."

Such comments as the preceding, from London, are sincerely appreciated. They are worded as a tribute to the ELECTRICAL WORLD, but the credit belongs to the electric power industry in the United States. An official agency may exert a certain amount of pressure, but an unofficial agency can present a statistical summary only because it has been accorded the voluntary and wholehearted co-operation of those from whom information is solicited. That willingness to contribute to the general fund of information has been regarded by competent students as a conspicuous characteristic of progressive American industry.

McGRAW-HILL PUBLISHING COMPANY, INC.
Tenth Ave. at 36th St., NEW YORK, N. Y.

JAMES H. McGRAW, President
JAMES H. McGRAW, JR., V.-Pres. and Treas.
MALCOLM MUIR, Vice-President
EDWARD J MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
C. H. THOMPSON, Secretary

NEW YORK Dist. Office, 285 Madison Ave.
WASHINGTON, National Press Bldg.
CHICAGO, 7 South Dearborn St.
PHILADELPHIA, 1600 Arch St.
CLEVELAND, Guardian Building
ST. LOUIS, Bell Telephone Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie Street, London, E. C. 4

Cable Address "Machinist, N. Y."

The annual subscription rate is $5 in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, Haiti and Paraguay. Extra foreign postage, $4 (total $9 or 38 shillings). Subscriptions may be sent to the New York office or to the London office. Single copies, postage prepaid to any part of the world, 25 cents.

Change of address — When change of address is ordered the *new* and the *old* address must be given. Notice must be received at least ten days before the change takes place.

Copyright 1928 By McGraw-Hill Publishing Company, Inc.

Published weekly
Entered as second-class matter Jan. 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879.
Printed in U. S. A.

Circulation of this issue, 19,500

Publishers of
Engineering News-Record — American Machinist
Power — Chemical and Metallurgical Engineering
Coal Age — Engineering and Mining Journal
Electrical Merchandising
Ingeniería Internacional — Electric Railway Journal
Bus Transportation — Construction Methods
Electrical World — Radio Retailing
Electrical West
(Published in San Francisco)
American Machinist—European Edition
Published in London

Member Audit Bureau of Circulations
Member Associated Business Papers, Inc.

Advertising Index—Alphabetical, 120; Classified, 114, 116, 118; Directory of Engineers, 52, 53; Searchlight Section, 54-60

165,000 ft. of Hazard Parkway Cable used in the City of Lima, Ohio

Safe underground —with no need for conduits

HAZARD

Steel Tape Armored Parkway Cable

WITH its insulation guarded by a sheath of lead and by an armor of steel tape, Hazard Parkway Cable is *safe* underground. This eliminates the cost of conduit installation—the tearing up of streets, the construction of manholes, the interruption of traffic, the repaving of streets and the final drawing-in of the lead covered cable. It provides, in other words, a long lived and ever dependable installation while the many miles of Hazard Parkway Cable now serving in all sections of the country give ample testimony with respect to its reliability and its economy of maintenance. We will be glad to furnish you this evidence and any further information you may wish.

Write for our Parkway Cable Booklet

HAZARD INSULATED WIRE WORKS

Division of the Okonite Company

WORKS: WILKES-BARRÉ, PA.

Sales Offices:

New York **Chicago** **Philadelphia** **Pittsburgh** **St. Louis**
Atlanta **Birmingham** **Seattle** **San Francisco** **Los Angeles**

Electrical World

Published by McGraw-Hill Publishing Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 91 — *New York, Saturday, March 17, 1928* — NUMBER 11

Water Power Not in the Discard

WHILE steam is and will be the mainstay of the electric light and power industry, water power is by no means in the discard. True, there have been wonderful improvements in steam-plant equipment which have added perceptibly to steam-station economy, and there are possibilities for still greater improvements; but that does not mean that water-power development will necessarily cease or that steam-plant production will totally eclipse water-power production. So far as hydro-electric possibilities are concerned, there are as good fish in the sea as ever were caught, nor has water-power development received the setback that many suppose. The Federal Power Commission is receiving applications for water-power development at the rate of one hundred a year. Construction has been definitely authorized for six million horsepower, of which two million is completed and in operation. Five and a half million more is under investigation by preliminary permittees, and fifteen million horsepower is covered by applications not yet acted on. Approximately one-third of the total electrical energy generated is produced from water power.

Unfortunately, the development of many large power sites is being held up temporarily for political reasons. For example, there are five projects on the St. Lawrence River, involving approximately five million horsepower of installed generating equipment, which cannot be acted on until Canada and the United States agree on an acceptable scheme of development. Thirty-four projects, representing nearly six million horsepower, are held up pending the ratification of the Colorado River compact. There are also awaiting action applications for sites on the Tennessee involving more than three-quarters of a million horsepower. Hydro-electric development has nevertheless been progressing at a fair rate, but it will not, because of the nature of the business and the location of the water power, grow as rapidly as steam-station development. However, there are many millions of horsepower awaiting development which economically cannot be touched, so far as price of output is concerned, by any steam station, and it would be unfortunate if the general improvements being made in steam-station design should blind operators to these hydro-electric possibilities.

* * * *

Stock Dividends and Public Relations

THE flame of public criticism which is frequently turned upon the public utilities usually springs from misunderstanding or willful misrepresentation of some policy or practice pursued by them. The method of distributing earnings not infrequently has been the occasion, and the payment of stock dividends has sometimes been the center of attack. This has been represented as a means of obscuring unduly large earnings—of passing on to the stockholders the returns from exorbitant rates to consumers. Such arguments, although decidedly transparent, provide excellent fuel for unscrupulous politicians and others. Much or all of the misunderstanding would be avoided if those utilities concerned would point out to the public that through the stock dividend they have been able to obtain new capital cheaply; that, rather than pay out cash, they have issued stock-dividend certificates as evidence that a portion of earnings otherwise available for cash dividends has been transferred from surplus to capital account and permanently invested in the business. And this, incidentally, should answer the charge that the sole purpose of such dividends is evasion of income taxes.

Among others who should benefit from such explanation are certain writers of financial articles for newspapers who for the sake of arresting attention and providing striking headlines indulge in the use of such thoroughly misleading terms as "melon," "handout" and "Christmas gift." While the irrelevance of such expressions to the utility field is obvious to those familiar with financial practice, it may not be so evident to the general public. The use of such terms and the general misconception which exists involve the germ of much mischief to the utilities. It is much easier to eradicate the germ than to correct the mischief.

* * * *

Time Lag of Spark Gaps

ADVANCE in the electrical art has almost invariably been accomplished through empirical and cut-and-try methods. Discovery of a new phenomenon has always been followed by efforts in the shop and factory to make use of it, and generally the resulting product is only a first step which is soon outdistanced as the result of competent scientific investigation looking always toward improvement. Early devices yielded more promptly to the study of underlying principles because of their relative simplicity. However, with increasing values of power and voltage, with increasing demand for refinement of measurements and with the use of higher frequencies, many more involved relations have appeared, requiring longer and longer and more and more careful study.

One class of phenomena has been particularly obstinate and difficult to analyze—namely, the behavior of the high-voltage spark gap. The importance of the spark gap in all forms of protective equipment, and the consequent importance of knowledge as to its time lag in relation to the protection afforded, are well known. The matter has been studied for years, and many more or less conflicting explanations, none of them entirely convincing, have been offered in explanation of the time lag of the various types of spark gap. Early experimenters showed the influence of ultra-violet light and other evidence

that the phenomenon of breakdown in gaps is related to the condition of the intermediate gas as regards ionization. In a general way it has been recognized that the final rupture of a gap occurs through ionization by collision, but no certain laws under which the behavior of a gap may be predicted have been proposed.

At the recent winter convention of the American Institute of Electrical Engineers a further contribution to this important and interesting field was made in the paper of J. J. Torok. Using a form of impulse generator different in form from that proposed by Peek some years ago, Mr. Torok has succeeded by reflection methods in cutting off the value of a voltage impulse on a gap at any point on the curve representing the rise of the surge. In this way and with the aid of photographic methods he has studied the successive stages of the initial discharge leading finally to sparkover. Contrary to accepted opinion, a large sphere gap is found to have a definite period of preliminary discharge. Further experiments revealed the important influence of the initial state of ionization in the gap both on the preliminary form and on breakdown value of the gap. The result indicated that it will probably be difficult to control these factors, thus suggesting that the sphere gap will always require very great care and can probably never be an instrument of precision.

An important application of this suppressed-discharge method is in the opportunity it affords for studying the distribution of high-voltage electrostatic fields, as, for example, the fields around suspension insulators with arcing horns, rings and similar equipment. The suppressed discharge method constitutes an important new instrument in the fields both of scientific research and practical engineering developments.

* * * *

High-Pressure Steam Winning Many Victories

PLENTY of expectation has been current that operating troubles would increase faster than a straight-line ratio using steam above 400 pounds pressure and 700 degrees total temperature. Through the eyes of ultra-conservatives apparatus for these heavy duties has been skeptically regarded in not a few installations. However, evidence has been growing that the art has been permanently advanced by raising pressures and temperatures, although the industry is still too much in the dark as to the economic justification of these new developments.

George A. Orrok gave the recent Midwest Power Conference at Chicago a valuable paper upon operating experience with high-pressure and high-temperature steam, and his conclusions that there now appear to be no serious difficulties up to at least 2,000 pounds are indeed significant with respect to the solution of the important physical and metallurgical problems concerned. Reports from a representative number of high-pressure installations declare that most of the anticipated troubles with equipment have been absent and that operating difficulties are on the whole no greater than with the ordinary 200-pound stations. Most of the troubles reported pertain to minor though essential equipment, like gage glasses, fittings, glands, gaskets, and so forth, and have been well taken in hand. The boilermakers state their readiness to guarantee service up to 900 degrees Fahrenheit when specified, and alloy steels for tubes, shells and castings are now available for more difficult operating conditions than have prevailed in the past. Operators report both thermal and commercial economy in the use of higher pressure, and this is borne out by repeat orders for similar apparatus, probably the best of all indications of success.

The favorable results which have been coming to light in regard to the operation of high-pressure and high-temperature plants should be supplemented in the near future by the release of more over-all cost data and analyses. When these become more generally available, engineers will be in a still better position to determine the most economical pressure and temperature to use in a particular case. Unless the economic factors in plant experience are liberally exposed to the analytical fire of the profession, progress will be slower than the splendid achievements of physical and chemical engineering in this field deserve.

* * * *

Commercial Section Turning to Broader Objectives

PRACTICAL possibilities for constructive work by the commercial men of the power industry were never better indicated than at the meeting of the N.E.L.A. Commercial Section executive committee in Chicago last week. It was not that so much was accomplished. Rather, the time set apart for the meeting was more adequate and there ensued an unhurried discussion that went further afield and to more purpose than has been usual in the past.

For the last year or so undoubtedly the pressing problems of the residence market have held chief attention. This was well, for the great need has been to awaken the utilities to the passing of the old era of growth by the accumulation of customers, to confront them with the need for large-scale selling if expansion in this vast market is to continue. This work must go on until universal acceptance and action are realized. But undoubtedly a movement has been started. It has been reflected in many ways—the reorganization of the Society for Electrical Development, the holding of the intertrade merchandising conferences, the calling of the Industry Sales Conference, now at work; the appointment of a commercial director at N.E.L.A. headquarters, and the general quickening of executive interest. Meanwhile other committees have been at work, but the limelight has been on the domestic market.

Last week attention was also very definitely directed toward the field of power and industrial heating. Power has been more or less taken for granted in recent years, yet connected industrial customers are said to average only a 50 per cent utilization of electricity, and the use of steam, oil engines and private electric plants within easy reach of power lines still bulks very large. The difference in the extent to which power has been sold in different cities attests how great a factor good selling has been. And so it is with industrial heating. A tremendous volume of profitable factory load only waits upon an intensive study of local possibilities and the skilled man power needed to do the selling, not by talking power but by its intelligent application to the production problems of factories.

The meeting recognized that this work must now have energetic leadership—also that power men must take a more constructive part in the development of the wiring code. Such objectives can be facilitated by the new commercial director. Clearly, there is urgent need in

all this work for a more effective procedure in the organization itself, that the work of committees can have more continuity, with less time and effort lost in meetings and between them.

* * * *

Standardize High-Voltage Tests

SUCH a variety of tests are being conducted in high-voltage laboratories that the data produced are frequently contradictory and sometimes very unsatisfactory. Yet the relative and absolute performance of insulators, arresters and cables is of fundamental importance to development and practical application of high-voltage equipment. In order that data obtained in different high-voltage laboratories may be compared, it would be advisable to specify the steepness of impulse waves, the frequency for oscillatory tests and other details. An "impact" test is meaningless unless the wave is defined and the regulation of the test equipment measured. To determine these quantities precision instruments could be incorporated in each laboratory. Temperature, humidity and wind conditions are other essential elements that must be definitely specified to make test data comparable.

Whatever may be the opinions regarding the phenomena which actually occur on lines or the relative merits of different tests for duplicating operating conditions, it would be logical to make tests that are comparable. The proper instruments are expensive, but they are available, and high-voltage test technique has proved fully adequate to obtain reliable results if conducted under specifications. By studying the possibilties of such procedure engineering groups can devise test methods which will avoid the confusion now prevalent.

* * * *

Selling Only Part of Load Building

UTILITY load-building programs do not end with contracts for power or for household appliances. The contract is merely a starting point for the formation of a seller-and-customer relationship which demands a great deal in cost and service from the seller. In large measure this fact is recognized by utility executives in building up a power sales program, because industrial specialists are carried on utility payrolls to serve as counselors to power customers. Funds are provided for advertising and sales agents to bring new industries into a territory, and in some cases the utility becomes a stockholder in the industrial enterprises. The utility accountants do not set up balance sheets per customer which embody all such indirect costs as part of the revenues and costs involved in kilowatt-hour billings.

The same principles hold good in load building with domestic customers. No utility should embark on an aggressive household load-building program without making provision for proper accounting and servicing. In the ultimate electrical home it will be profitable and necessary for the utility to provide a home-service counselor or service man. Load building in homes can stand on its feet as a merchandising business only when some degree of saturation is had in the use of electric appliances. In several cases, however, utility executives put all home load-building costs into an account called merchandising and expect a profit to show at the end of each year. For this reason some regulatory commissions point to red figures for merchandising and believe the utility is wasting money in an unprofitable business, and some utility executives wear long faces and think they have gone into an illusory business because of the same red figures.

In the initial stages of home load building it should be known that only small and well-introduced appliances can be sold on a profit-making merchandising basis. The range, refrigerator, water heater and other heavy-duty appliances must be pioneered and pushed into homes at a loss when they are considered as a merchandising enterprise and when they are new in a territory. They must be serviced often and promptly by the utility until other service agencies know how to do the work. Yet the only hope for ultimate development of business in the homes on an adequate and profitable basis lies in the sale of these pioneering appliances. Pioneering load-building costs are legitimate and should be met, but it is questionable practice to place all these costs in one account called merchandising and then have commissions and utility executives look askance at the red figures on the balance sheet because they do not understand the complete story of the costs involved in doing pioneering work in home load building. It would be well to divorce strictly store merchandising from home servicing and home appliance pioneering when computing costs for load building in homes.

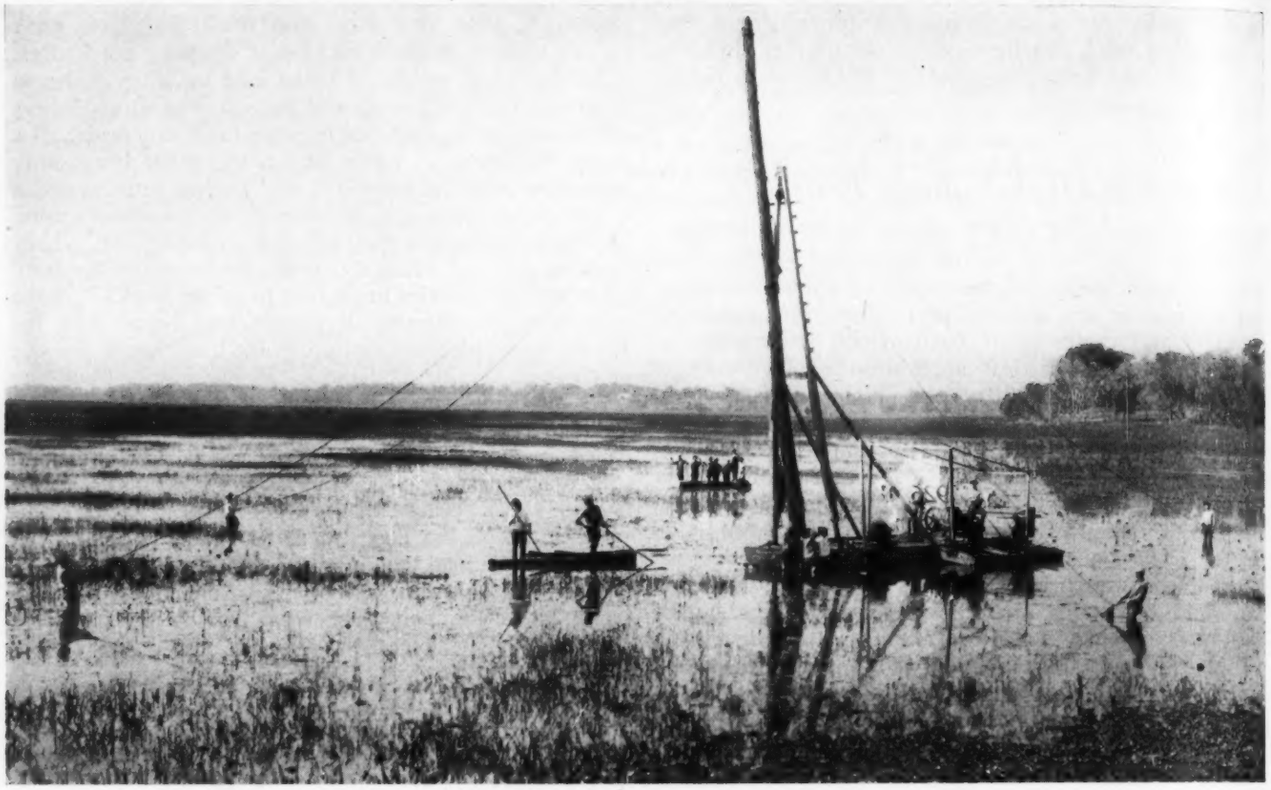
* * * *

Cable for High-Voltage Transmission

OVERHEAD transmission lines are exposed to mechanical and electrical hazards that make continuous electric service difficult and expensive. Multiple lines and circuits from multiple generating sources are required to give metropolitan service to a community. In some areas it has been suggested that high-voltage underground cables might be used to replace overhead transmission circuits and thereby render more continuous service because these cables would be immune from lightning and from the hazards of accidental mechanical contact. But great care must be exercised before drawing such a conclusion if the present service rendered by even low-voltage underground cables is under consideration.

Figures compiled over several years show about seven service failures per 100 miles of cable per year for low-voltage cables now in operation. This percentage of failure, translated in terms of high-voltage, single-conductor cable, gives a service continuity per 100 miles per year much inferior to that now rendered by a modern single-circuit 220-kv. overhead line. Many of these failures are not the fault of the cable manufacture, but the installed service is the only proper measure of service value. If cost values be also placed in the equation, it may be seen that any large use of high-voltage cable for transmission faces a very decided service and economic handicap.

The present state of the cable art is, however, no guarantee of future developments. There are no inherent technical handicaps to making reliable high-voltage cables, and, if available, their use would eliminate the hazard of mechanical contact inherent in exposed overhead lines. It is encouraging, therefore, to find high-voltage cables introduced and used in Chicago and New York to bring large blocks of power at minimum cost to areas of heavy load, because ultimate developments in the art point to possibilities of underground transmission which will give better service than can be expected from overhead lines. In the interim it is advisable to measure service values in terms of actual experiences.



Right-of-Way Difficulties Encountered Along Florida-Georgia Line

Rig for erecting poles in swampy sections and nature of timber land cleared

Line Construction Methods

Used in Florida-Georgia Work

Organization and handling of forces to speed completion of transmission lines and substations involved in expansion of National Public Service Corporation's system

By M. J. IDAIL* and C. E. BLAND†

IN THE spring of 1[illegible] the General Engineering & Management Corporation, operator and manager of the National Public Service System, entered upon a very extensive building program to meet the needs of the territory in Florida and Georgia. It had been decided that, in order to keep the standard of service in step with the increased importance of load, certain of the existing lines and substations were to be reinforced and revamped. There was additional available load in parts of the territory already served, as well as load to be had by line extensions. The company had also acquired a number of isolated, inadequate and expensively operated properties in South Georgia which had to be interconnected by a distributing transmission system, and this system in turn connected to the base power station then under construction in Florida. All of the requirements of this situation made speed of construction a paramount consideration. The demands for electric power were urgent at half a dozen places and it was necessary to start construction simultaneously at a number of widely scattered points.

Much of the line construction was through undeveloped and sparsely inhabited country. Right-of-way clearing was heavy and costly. The undeveloped nature of the country permitted the lines to be located on long tangents; there is one pole line tangent 30 miles long, and a number in excess of 10 miles, while the tower line has one tangent of 36 miles, one of 32 miles and several of 20 miles. The Tarpon Springs-Inglis section of tower line was located as close to the margin of the Gulf of Mexico as the swamp hammock would permit. Of necessity the line had to pass through a considerable amount of heavy cypress swamp. However, for a distance of 50 miles a high sandy ridge ideally suited to transmission line construction was found to parallel the coast just inside the hammock. Much of the hauling was done over the right-of-way.

The lines on the northern end of the system are for the most part built through dense turpentine woods. Florida is divided by section and range lines into sections nominally one mile square. Parts of Georgia are divided into land lots. In order satisfactorily to describe properties in the easements it was required that the lines be tied in to the section quarters and lot quarters. The labor and worry involved in making these tie-ins will be appreciated when it is realized that the original government surveys were made under the much-abused contract system around 1840 and that the pine stakes used as hubs have practically all become lost. To complicate matters further, most of the sections vary somewhat from the correct mile square.

At the start of the job a field office was opened in Ocala, Fla. A few weeks later, when both pole line and tower line work began to take on some momentum, a sub-office was opened in Thomasville, Ga. This arrangement held until the later stages, when the Ocala office was closed and the field office moved to Valdosta, Ga.

Transmission system of Florida Power Corporation, West Florida Power Company and Georgia Power & Light Company

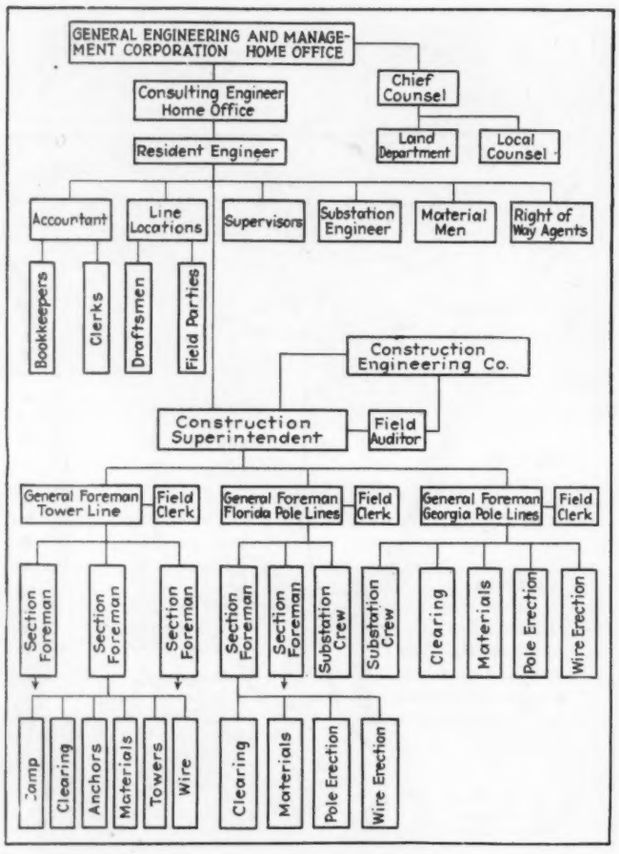
The general transmission voltage is 66,000 volts. To connect the Florida and Georgia 66,000-volt system to the Inglis station the Inglis-Tarpon Springs and Inglis-Jasper 110,000-volt trunk lines were built. The company has prepared preliminary plans for a hydro-electric development on the Santa Fe River; this development will feed into the trunk line also. Contrary to general impression, the central and western part of Florida is not all flat and low; there are hills and bluffs, giving rise to possibilities of water-power development. It is interesting to note that the only water powers so far developed, or in contemplation in Florida, are a part of this system.

*Engineer with Francis R. Weller, consulting engineer, Washington, D. C.

†Construction manager Hoosier Engineering Company, Chicago, Ill.

Although the operations in Georgia were several hundred miles distant from the Ocala office, the direction of all work was placed under one resident engineer and all accounting and disbursements were handled from the Ocala office. As the work progressed the wisdom of this arrangement was demonstrated; right-of-way and legal policies were kept uniform and details of accounting and engineering practice were standardized throughout the whole project.

While all right-of-way agents were directly responsible to the resident engineer in regard to progress, methods, payment, etc., the chief local counsel of the company



Engineering and construction organization chart

formulated policies and passed on decisions in all matters appertaining to legalities, titles, rights, etc. In each county where work was done the chief counsel retained a local attorney to advise the right-of-way department and to handle legal processes, such as condemnation suits, etc. Fifteen attorneys were so retained.

The county records of title in Florida in general are in poor shape due to the many transfers and subdivisions which have taken place during the past few years. It was found necessary for the chief counsel to form a land department to clear up titles in the easements after the right-of-way department had obtained easements sufficiently good to warrant proceeding with construction. It was entirely out of the question to delay construction until titles to properties involved were completed. The land department will not have completed its work for a year or more after construction has been completed. Even making these concessions the right-of-way situation, as it always does in such rush projects, controlled and limited construction rates.

The surveys and plotting of tower line and central Florida pole lines were handled under the direction of the locating engineer from the Ocala office; similar North Florida and Georgia work was handled under the direction of the assistant locating engineer from Valdosta. The Florida and Georgia right-of-way groups were entirely independent of each other.

Three chief inspectors, or supervisors, and a substation engineer formed the contact between the resident engineer and the four construction groups; i.e., tower lines, Florida pole lines, Georgia pole lines and substations, and relieved him of all details of construction. The resident engineer had no assistant; his contact with his department heads was direct and constant. The material men were charged with the receipt, inspection and check-out of all material. The actual construction organization will be described later. Designs and specifications were prepared in the office of the consulting engineer and that office initiated purchases of equipment and material and supervised field operations and methods in considerable detail. The general scheme of the program was determined at the outset by the General Engineering & Management Corporation and the clients' staff kept in touch on all matters of importance.

Construction Organization

The field supervisory organization included: A resident engineer; one accountant and five clerks; one locating engineer, one assistant, nine field parties, two chief draftsmen and five draftsmen; two right-of-way agents and nine men; three inspectors; one substation engineer and two assistants; two material men and two warehouse men.

The project as a whole was divided into 42 jobs, each authorized by an improvement estimate. Costs of each job were kept separately and in detail. Funds were advanced to the resident engineer upon his requisition, and all except unusually large invoices were paid by the resident engineer. At the close of each job a physical inventory of the line or substation was made, the material charges on the books checked against this inventory and necessary journal entries made to cause the books to show correctly the cost of each job. When the project was nearing the close an audit was made of the freight invoices; this audit resulted in substantial refunds because of overcharges.

Unit costs are satisfactorily low on all items except the right-of-way account. The high cost of right-of-way was due to the fact that the rush basis of the project allowed but little time for "dickering," and, further, timber damage cost was high because of valuable timber tracts passed through. Right-of-way clearing cost was also rather high since very little open country was encountered. Freight charges affected costs more than is usually the case; in terms of f.o.b. factory cost, freight varied from 10 per cent of material cost, in the case of insulators and conductor, to 30 per cent in the case of poles and crossarms.

The extent of the program and the time allowed for execution, if carried out entirely by the General Engineering & Management Corporation's own forces, would have necessitated a very large expansion of engineering, supervision and construction forces and equipment for a short period. On the transmission line and substation program the corporation retained Francis R. Weller as consulting engineer in charge of engineering, designs, surveys, rights-of-way and general supervision of construction, and contracted with the Hoosier Engineering

Company for the complete erection of lines and substations. The client placed a contact engineer on the job to act as its personal representative, to expedite decisions, etc.

The accompanying chart shows the form of the construction organization. A progress schedule was prepared for each job and sizes and number of gangs were determined by the requirements of these schedules.

the section of country where commercial timber was grown it was necessary to fell trees in a manner that would not damage other growing timber. It was also necessary in these sections to clean up brush piles thoroughly, as it is claimed insects which damage the growing timber breed in such piles.

Considerable hazard existed in burning brush, due to the possibility of fire spreading into the heavy woods;

Pulling logs from right-of-way with tractor (A), reel wagon that aided stringing of conductors (B) and placing anchor in hole (C)

These schedules were altered from time to time as the relative importance of certain of the jobs changed, or as caused by right-of-way hold-ups or other difficulties. Weekly progress reports were submitted to the client; each progress report showed the work of the past week and to date and contained a statement of work laid out for the coming week.

Right-of-way clearing crews were built up from native labor, largely colored. A great many of these men were found to be skilled woodsmen. The usual clearing crew consisted of about 40 men, with a sub-foreman for about every fifteen men. The crews were organized into units, one unit clearing out underbrush, another using axes for small timber, another using crosscut saws for larger timber and a fourth crew trimming and burning brush. In

for this reason special attention was exercised by crew foremen in watching these fires. When necessary to keep a fire burning after working hours, sufficient men were left to watch it. During exceptionally dry seasons brush burning was stopped entirely.

On the high ground pine timber predominated. In Florida the pine woods had largely been cut over. In Georgia, however, many tracts of large timber were encountered. In low sections of both Georgia and Florida very heavy timber growth was encountered. These dense woods consisted of live oak, gum, palm and pine, all tied together by a dense undergrowth.

For tower line construction a standard width of clearing of 100 ft. was decided upon and for pole line construction 50 ft. was standard. All tall timber outside of

this width, allowing for a five-year growth, which in falling would touch the line, was also cut. In a few instances large, substantial timber which appeared to be able to withstand high winds was left intact. All large pine timber, regardless of size, if tapped for turpentine, was cut, since experience has proved turpentined trees to be a hazard. Due to the long spans on tower line and consequent side swing of conductor in high wind additional clearing near the center of span was often necessary.

The standard type of tower anchor was the four-legged grillage. These anchors have a comparatively large bearing area to take care of poor soil compressive qualities in the swamps. The general character of the soil was a sand overburden with occasional clay outcrop. In numerous places limerock was encountered. At least 30 per cent of the anchors were installed in wet holes.

TABLE I—GENERAL FEATURES OF STANDARD 66,000-VOLT LINE CONSTRUCTION

It is quite general practice throughout Florida to use pin-type construction on 66,000-volt lines. This is no doubt due to the fact that the load density per mile of line is rather low and the economics of the problem require the cheaper pin-type construction rather than the more desirable (and more expensive) suspension design. The absence of the necessity to design for ice loading makes the comparatively long standard span quite safe. The standard span is shortened to 300-350 ft. when the line is constructed along a road, or carries two circuits. Carrier-current communication is used for load dispatching and system operation.

Cypress poles, untreated; standard length, 40 ft.
Triangular spacing of conductors, 6-ft. spacing, using pole top pin arrangement.
Creosoted pine cross-arms, 8 lb. open cell, long-leaf yellow pine.
Pin-type insulators, four-piece, cemented thimbles.
No. 1/0 A.C.S.R. conductor.
Standard span, 400 ft.
Safety Code clearances to ground.
Design loading, 11 lb. wind, no ice, 32 deg. F.
No dispatching telephone circuit.

In the sandy soil, even though dry, it was necessary to crib the sides of the excavation with planks. In wet soil it was necessary to drive sheet piling and pump the excavation. For locations with a small amount of water hand-operated diaphragm pumps were used. For anchors set in extremely wet places power-driven diaphragm pumps were used. Numerous places were encountered where eight power pumps could not keep the water down. A few instances were encountered where soil would not support the load imposed. In such cases piling was driven to firm bearing and the top of piling capped with a concrete mat, upon which the grillage anchors were installed.

Limerock in the presence of water constituted the most difficult footing condition encountered. The average limerock could be broken up with a stone sledge and small charges of dynamite. However, for a section of line just north of Inglis, Fla., a harder grade of rock was encountered. This was handled by means of an air compressor, jackhammer and dynamite.

For approximately 20 miles north of the Inglis steam plant the tower line passed through a section of the densely timbered swamp land bordering the Gulf of Mexico. Operations were started in this section in December. Due to the fear of the spring rainy season tieing up operations entirely, all hands were concentrated on this section in the endeavor to have anchors installed and material delivered by the following April. As the rainy season was late the work was well ahead by the time the heavy rains arrived.

The lower 10-ft. section of the tower was designed for use as a template in lining up and leveling the footings. The use of this arrangement prevents the anchor from sinking in toward the center of the tower and thus causing delay in erecting the superstructure. The use of the tower section as an anchor template eliminates transporting a heavy template from tower to tower; this item alone contributes a considerable saving in cost. Objection to this method is made by those who favor erecting the tower from the prone position. This objection, however, was discounted because of previous successful experience with the built-up or piece-by-piece method of tower erection. A foreman and ten men with a 1-ton truck comprised the average anchor crew.

Tower Erection

As previously mentioned, the built-up method of tower erection was used. One great advantage of the built-up method is the small amount of equipment needed. This method limits the equipment required per crew to four handlines, six end wrenches, six socket wrenches with handle drawn out to a drift, one light gin pole with guide iron, chain, pulley and rope. The crew consists of four climbers, four groundmen, one assembler and one foreman. A truck was furnished for each two crews.

To speed up the erection of towers, a bonus system was devised whereby each member of the tower crew received an additional hour's pay for each tower erected above the minimum required. In this way excellent co-operation was obtained. Erection was facilitated by the fact that all tower pieces were well fabricated and marked. Some of the tower shipments were made by rail and water and some slight confusion was caused thereby.

The 4/0 A.C.S.R. conductor was strung out by means of a reel wagon pulled by a caterpillar tractor. The three reels were loaded on the wagon and as each tower was passed the conductor was raised to roller bearing snatch blocks suspended from the crossarms. As ends of the conductor were reached other reels were loaded on the wagon and the two ends spliced with a double sleeve joint. This method of laying out the conductor reduced the chances for abrasion to the minimum, since the conductor was not pulled over any rocks or barbed wire fences.

TABLE II—GENERAL FEATURES OF 110,000-VOLT CONSTRUCTION

It might be thought that since the lines are not designed for ice loads, comparatively small conductor sags and low towers would suffice for the desired long spans. This is not true, however, because of fear that a high day-after-day tension in the conductor would lead to vibration troubles; the sags adopted are but slightly less than those which would have been used in designing for Class B loading.

Double-circuit, galvanized steel towers.
One No. 4/0 A.C.S.R. circuit present with provision for second circuit and ground wire.

Height from ground to low crossarm	65 ft.
Vertical spacing between crossarms	10 ft.
Height to top of tower	90 ft.
Horizontal clearance between circuits	20 ft.
Insulation { Eight units in suspension and semi-anchor. Nine units in dead-end position.	
Standard span	1,300 ft.
Average span	1,230 ft.
Longest span	1,500 ft.

Design load, 11 lb. wind, no ice, 32 deg. F.
Tower specification: Towers required to withstand test loads 50 per cent greater than loads corresponding to 11-lb. wind, no ice, on 1,300-ft. span. Type A tower designed for 5-deg. line angle; type B tower, 45-deg. line angle.
Type of anchor, square earth grillage.
Tower weights:

Type A superstructure	7,130 lb.
Type A anchor	1,270 lb.
Total type A tower	8,400 lb.
Type B superstructure	9,600 lb.
Type B anchor	4,275 lb.
Total type B tower	13,875 lb.

Two-mile sections were used in sagging in; type B towers with semi-anchor insulator assemblies were in-

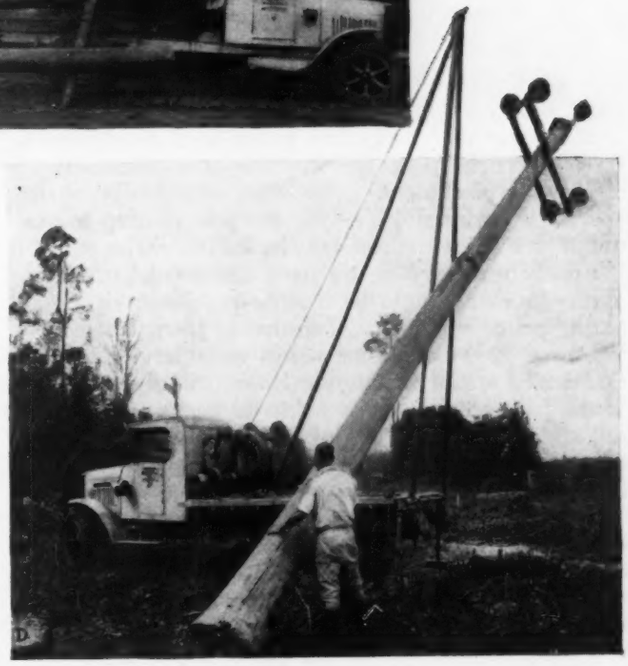
serted at approximately 2-mile intervals, and these towers divided the line into convenient sections for sagging purposes. Dynamometers were used in giving the conductors a test pull of 3,000 lb. After the test pull the conductors were slacked off to the stringing tension of approximately 1,500 lb. The correct sag was determined by sighting in with a sag line and targets and the corresponding tension was checked by dynamometer. Specially designed Chicago grips were used to catch off the conductor. At each B tower two sets of grips were used with chain and turnbuckles to catch off between sags and to hold the test pull. After sagging was completed a small gang with a truck clamped in the insulator assemblies on the intervening suspension towers and also picked up the snatch blocks. The average wire crew comprised a foreman and twelve men with a tractor and two trucks.

Motor trucks were used throughout the work wherever possible. In the sections not cultivated trucks often traveled the right-of-way. In low land it was necessary to use teams or tractors to place the material. In tower distribution one complete tower was hauled per trip with a 2-ton truck. For pole hauling 2-ton trucks with pneumatic-tired trailers were used. As the cypress poles were very heavy, the average load was four poles. Often poorly constructed bridges limited the loads hauled.

Truck depreciation was unusually high. The sandy soil was hard to pull through and was extremely hard on pneumatic tires. At the peak of the construction as many as 50 trucks, five tractors and six trailers were used on construction and material delivery. In addition, 29 passenger cars were used by the right-of-way, survey inspection and supervision forces.

On 130 miles of the tower line it was necessary to use construction camps. Each camp was designed to care for 60 men and had a camp force of one cook, two helpers and a flunky. The camps were run under the direction of the respective section foremen. Two complete camp equipments sufficed; a camp handled a section about 20 miles in length and the camps were moved as construction progressed.

Due to the presence of malarial fever it was necessary to watch sanitary conditions very closely. Each bunk tent was thoroughly screened. There was practically no sickness on the job. Eacn man staying in camp was charged $1.25 per day, but this fell considerably short of meeting camp operating and depreciation expenses. The camp deficit was a comparatively small portion of the total cost of the job and was cheerfully accepted as being offset by the good morale of the men.



Pole truck and trailer (A), special transformer hauling rig (B), loading poles with truck winch (C) and pole setting equipment (D)

The majority of the poles were set with 2-ton trucks equipped with derricks and winches. All poles were framed and cross-arms and insulators attached before raising. This method allowed the use of groundmen for this work instead of the higher priced linemen. In swampy places the poles were erected by use of a gin pole cart with team or tractor.

A large number of wet holes were encountered in the loose, sandy soil and hole digging under such conditions was quite a troublesome and expensive job. Great success was had in setting these poles with dynamite; i.e., "shooting them in." The method is as follows: First, a 2-in. pipe is driven into the ground to approximately the depth to which it is desired to set the pole. The dirt inside the pipe is then augered or bailed out, after which a charge of 40 per cent dynamite, usually about two sticks, depending on the texture of the soil, is inserted. The pipe is then pulled out, leaving the charge about 6 to 7 ft. in the ground, and the pole is erected directly over the charge and guyed with hand-lines, or if it is a light pole, the workmen can hold the pole erect with pike poles. The charge is then exploded, opening a cavity and allowing the pole to drop to position, after which the soil falls back around the pole. It is usually necessary to use some additional backfill, but not as much as might be imagined. The cavity is not much greater in diameter than that of the pole itself and the force of the explosion seems to be largely upward. Sometimes a shot that is too heavy will shatter a part of the pole. This method works to perfection in sandy soil and can be used in clay soil, although not so successfully, since preliminary shots are required to loosen up the soil.

A number of unusual and interesting problems were encountered in building the pole lines. For about 20 miles one line was built parallel to an old logging railroad and 25 ft. from its center line. A small locomotive and several flat cars were rented and a gas engine derrick was built on one of the flat cars. Poles, cross-arms, insulators and hardware were first delivered and then pole erection was started. It was necessary to shoot in most of the poles. Two crews were used; one, with the derrick, stood the poles up and guyed them, and the other gang followed, shooting and removing the guy lines. The conductor was pulled out from a reel wagon mounted on a flat car.

Another interesting job, described in the ELECTRICAL WORLD, April 30, 1927, was the erection of a 2-mile section of line across a swamp in which the water varied in depth from 2 ft. to 6 ft. The poles were set up by means of a derrick built on an old barge and then shot in. Each pole was side guyed with screw-type anchors to insure permanent stability.

The rates of progress varied considerably on the various jobs. The organization was planned and equipment mobilized in anticipation of a schedule considerably faster than that actually realized. Even though the speed of construction be considered more important than keeping costs to a minimum, practically, the limit is soon reached. Property owners will not be rushed into giving easements; to attempt to do so simply results in sending prices sky high. Legal processes take time and lots of it. The workmen were frequently reminded of the importance of avoiding unnecessary crop and fence damage and of getting on well with the people in general. Very little trouble occurred in this connection.

Installing anchors in swamp under difficult conditions

SUBSTATION ERECTION

Substation gangs were organized apart from the pole-line crews, as many as six gangs being used on the project. A great many temporary installations were made to provide service during reconstruction. On the larger stations the crews were divided into units, such as foundation crew, steel and equipment erection crew and electrical crew for switchboard and wiring work.

Prior to the 1926-1927 program the transmission system comprised approximately 260 miles of 66,000-volt line and 90 miles of 44,000-volt and 22,000-volt construction. At the completion of the program the 66,000-volt lines will have increased to more than 730 miles, and 178 miles of 110,000-volt trunk line connecting the Florida and Georgia systems will have been built. The 66,000-volt substations will have increased in number from 22 to 45. Sixteen small, over-loaded, uneconomical generating plants will have been shut down. In addition to the transmission work here described, the distribution systems in St. Petersburg, Clearwater and Tarpon Springs were entirely rebuilt and a 25,000-kw. oil-burning generating station constructed at Inglis, Fla. The Inglis station was designed and constructed by the General Engineering & Management Corporation's own forces. A 10,000-kw. (ultimate capacity) hydro-electric

development is under construction at Jackson's Bluff, near Tallahassee, the state capital of Florida, and will be tied in with this development.

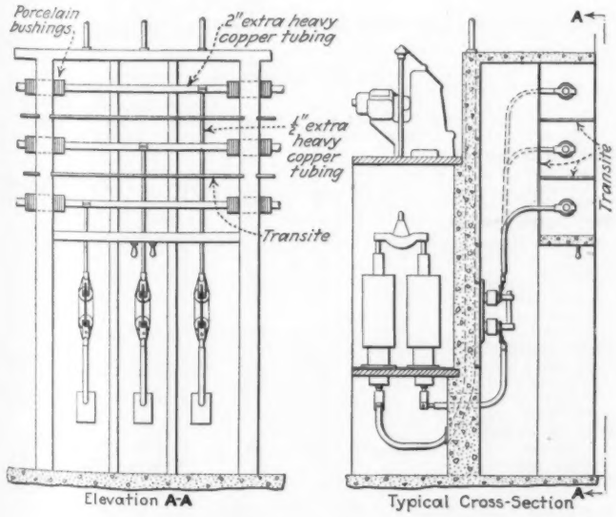
Experience on a project of this size brings out very forcibly the advantages and necessities of certain arrangements which on smaller projects are equally important but may not stand out so strongly. The accounting system must be such that money will be available for the prompt payment of invoices. There must be a sufficient number of bookkeepers and office men to keep the books properly and in detail; incorrect entries must be corrected by journal entries as soon as discovered, even though there may tend to be a multiplicity of journal entries.

Ample, if not even an excess, construction equipment is a necessity on a rush job; this is particularly true in the case of trucks. The importance of the position of chief of the party on line location is often underestimated. It pays to employ a high type of experienced man for this work.

The entire transmission project was under the direction of H. D. Panton as resident engineer for Francis R. Weller. The General Engineering & Management Corporation gave general supervision to the project. Admirable co-operation between the client's operating departments and the engineer's and contractor's forces contributed much to the satisfactory handling of the project.

Porcelain Bushings Support Tubular Bus

IN USING tubular copper bus in several of its substations the Portland (Ore.) Electric Power Company has developed the type of support shown. Porcelain bushings, through which 2-in. extra-heavy copper tubing passes, are cemented into the cell barriers. This type of support requires a minimum number of insulators and



Bus structure supported by barrier bushings in substation

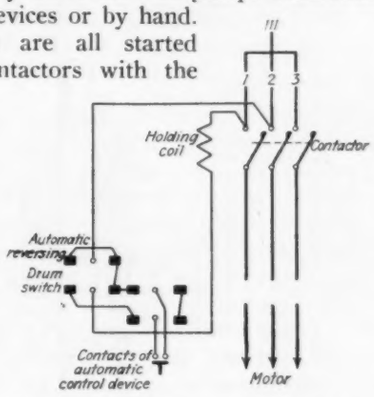
has ample strength for taking care of very heavy short-circuit stresses. A cushion is obtained for the tubular bus by inserting packing around the tubing where it passes through the supporting insulator.

Reversing Drum Switch Transfers Motor Control

By C. B. Carpenter
Engineering Department, Washington Water Power Company, Spokane, Wash.

A SIMPLE and reliable method of transferring control of motors from automatic to hand control is often desired in the case of pumps, blowers and other machines controlled by automatic devices, such as float or pressure switches. Such a device should be simple and rugged and should permit the motor to be operated independently of the control device, under control of the device or stopped and made non-automatic, as may be desired by the operator.

At the Chelan hydro-electric plant of the Washington Water Power Company there are five pumps controlled either by automatic devices or by hand. The driving motors are all started by across-the-line contactors with the control device connected in the circuit to the holding coil of the contactor. The device used for this purpose is a reversing drum switch of standard manufacture suitable for small motors on circuits up to 600 volts. Its cost is about the same as a push-button station which will perform a similar function on a 440-volt circuit. The contacts in the switch are rugged and have ample carrying capacity for any contactor coil circuit that may be utilized.



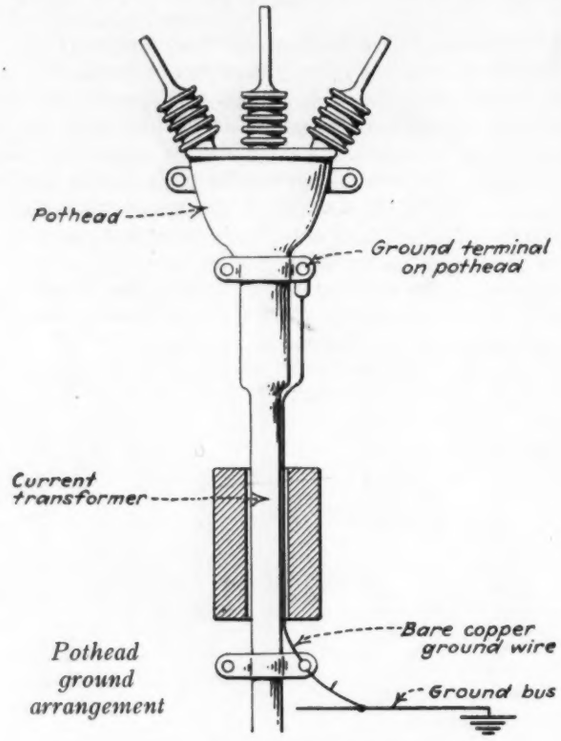
Connections for reversing drum switch adapted to transferring motor control from hand to automatic operation

When the reversing switch is connected as shown in the accompanying diagram and is in the off position, the control circuit is open and the motor is off. When thrown to one side the contactor coil circuit is connected in series with the contacts of the float switch or other automatic device and the motor is subject to the control of that device. If the switch is thrown to the opposite position, the contactor or control circuit is closed and the motor will run independently of the position of the contacts in the automatic control device. In the case of small direct-current motors the main line of the motor can be controlled by the drum switch. The drum switch is so small that it can be mounted at any convenient point. At Chelan the switches are mounted on the motor frames, affording unit construction.

With its positions marked "Run," "Off" and "Automatic" the operation of the switch is almost self-evident, whereas if push-button stations were used for the same service the operation would neither be so simple nor reliable. It was found in the case of a 440-volt circuit that the small reversing drum switch cost only half as much as two push-button stations that would have been required to perform the same function. Moreover, tampering with the automatic control device is avoided in case it is desired to operate the machinery irrespective of the position of the control device.

Cable Pothead Protection

FROM F. B. Haugaard of the Electricity Department, Sydney, Australia, comes a note of comment on a short article entitled "Place to Ground Cable Sheaths" and published in the ELECTRICAL WORLD, April 23, 1927.



Pothead ground arrangement

Mr. Haugaard points out the desirability of a ground connection at the pothead itself, on account of the fact that "a considerable percentage of failures occur in potheads." As a means to prevent ground return currents in the cable sheath from setting up a flow in the secondary of the transformer and also to provide a ground connection at the pothead, he presents the arrangement shown in the accompanying sketch. In this, the ground wire attached to the pothead is brought back alongside the cable sheath through the current transformer opening, is clamped to the sheath below the transformer and goes to ground. The bolts supporting the potheads are insulated with fiber bushings and washers in order to assure the complete return of sheath currents along the ground wire and back through the current transformer. The ground return current in the sheath is thus balanced by the current in the ground wire and no flow is set up in the secondary of the transformer.

Generator Rating Close to 30,000,000 Kva.

AN INSTALLED capacity of 29,629,000 kva., operated by 2,806 companies and municipalities, while 1,644 additional systems use purchased energy exclusively, constitutes the generating equipment in public utility electric light and power plants in the United States (not including Muscle Shoals) at the beginning of 1928.

Of the 4,450 systems in all, 2,477 are commercial and 1,973 municipal, though the total generator equipment in the latter is relatively small.

The figures here presented are the result of a comprehensive and critical recheck by the ELECTRICAL WORLD of data from all available sources of information, including some material not obtainable until very recently.

The revision shows a slight increase in rating, confined to no particular section of the country, over the previous determination as of the end of 1927. A few additional operating companies have also come to light.

Particular care has been taken properly to allocate the plants of companies operating in more than one state, though operations are reported from one central office.

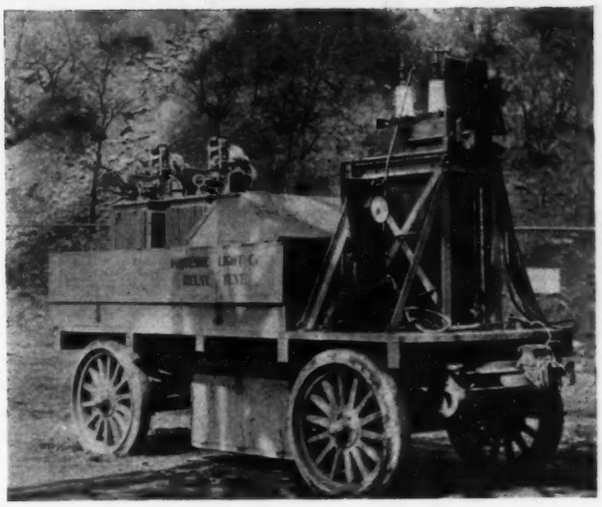
Number of Central Station Operating Systems and Installed Generator Rating, Jan. 1, 1928

State	Number of Operating Systems: Total	Commercial	Municipal	Systems Generating Energy	Systems Purchasing All Energy	Generator Rating, in State, Kva.
United States*	4,450	2,477	1,973	2,806	1,644	29,629,000
New England	326	253	74	178	148	2,396,000
Middle Atlantic	414	311	103	237	177	7,191,000
South Atlantic	527	280	247	345	182	3,746,000
East North Central	1,004	540	464	527	477	7,083,000
West North Central	1,108	437	671	679	429	2,167,000
East South Central*	220	135	85	183	37	1,341,000
West South Central	386	207	179	341	45	1,240,000
Mountain	290	199	91	210	80	1,093,000
Pacific	175	116	59	106	69	3,372,000
New England						
Maine	62	56	6	34	28	217,000
New Hampshire	38	34	4	25	13	107,000
Vermont	58	43	15	32	26	108,000
Massachusetts	123	81	42	60	63	1,185,000
Rhode Island	10	9	1	5	5	248,000
Connecticut	35	29	6	22	13	531,000
Middle Atlantic						
New York	184	137	47	116	68	3,577,000
New Jersey	25	13	12	18	7	775,000
Pennsylvania	205	161	44	103	102	2,839,000
South Atlantic						
Delaware	9	3	6	6	3	41,000
Maryland	41	31	10	26	15	330,000
District of Columbia	3	3	0	1	2	185,000
Virginia	56	40	16	44	12	321,000
West Virginia	48	42	6	27	21	819,000
North Carolina	118	59	59	61	57	615,000
South Carolina	66	35	31	45	21	585,000
Georgia	115	31	84	77	38	536,000
Florida	71	36	35	58	13	314,000
East North Central						
Ohio	235	123	112	111	124	1,976,000
Indiana	165	89	76	82	83	724,000
Illinois	201	117	84	117	84	2,342,000
East North Central *Continued*						
Michigan	181	77	104	119	62	1,344,000
Wisconsin	222	134	88	98	124	697,000
West North Central						
Minnesota	192	69	123	104	88	498,000
Iowa	172	81	91	85	87	548,000
Missouri	152	95	57	105	47	516,000
North Dakota	104	65	39	81	23	33,000
South Dakota	80	33	47	55	25	65,000
Nebraska	214	55	159	131	83	179,000
Kansas	194	39	155	118	76	328,000
East South Central						
Kentucky	68	58	10	56	12	259,000
Tennessee	66	44	22	54	12	439,000
Alabama*	32	15	17	21	11	*568,000
Mississippi	54	18	36	52	2	75,000
West South Central						
Arkansas	51	36	15	47	4	118,000
Louisiana	58	16	42	54	4	217,000
Oklahoma	107	35	72	88	19	211,000
Texas	170	120	50	152	18	694,000
Mountain						
Montana	34	31	3	27	7	328,000
Idaho	39	22	17	22	17	228,000
Wyoming	34	25	9	25	9	31,000
Colorado	65	32	33	51	14	257,000
New Mexico	25	22	3	23	2	19,000
Arizona	43	34	9	32	11	44,000
Utah	36	21	15	23	13	170,000
Nevada	14	12	2	7	7	16,000
Pacific						
Washington	76	52	24	41	35	635,000
Oregon	36	24	12	30	6	300,000
California	63	40	23	35	28	2,437,000

*Figures for Alabama do not include Muscle Shoals plant, in Alabama, 230,000 kva.

Field Testing of Relays

By W. M. Evans and R. J. Salsbury
Duquesne Light Company, Pittsburgh, Pa.



Outfit for 22-kv. tests, mounted on a trailer

In April and May, 1927, 443 grounds were applied to the Duquesne Light Company system, in order to check relay operation. There was one failure of service at 2 a.m., no failures of equipment and no injury to personnel.

The relay protection of a pure radial transmission system is comparatively simple. As the transmission layout becomes more complicated and grows into a network, the relay problem also grows with a degree of complexity which is much more rapid.

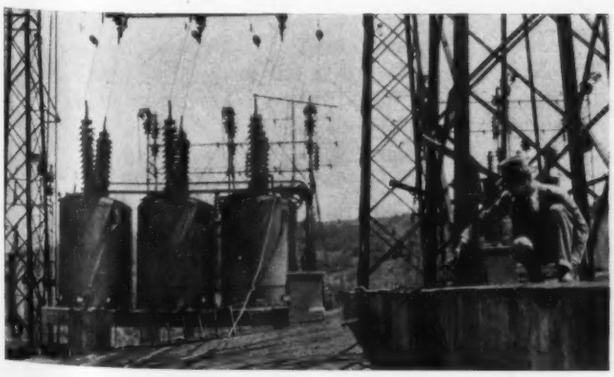
The testing of these relays and the wiring check-up in the field is very complicated, due to the location of many customers on the loops, to the power factor of the current on many lines, and to the regulation. It was not possible, except in a very few cases, to obtain the flow of power whose direction and stability are sufficiently determined to make an accurate phantom and polarity check. Some of the wiring combinations were quite involved, so that it was possible that wrong connections had crept in. Therefore, it was determined to make absolutely certain as to the performance of the relays by actually putting a ground on the system and permitting it to be cleared as under service conditions. This procedure has several advantages:

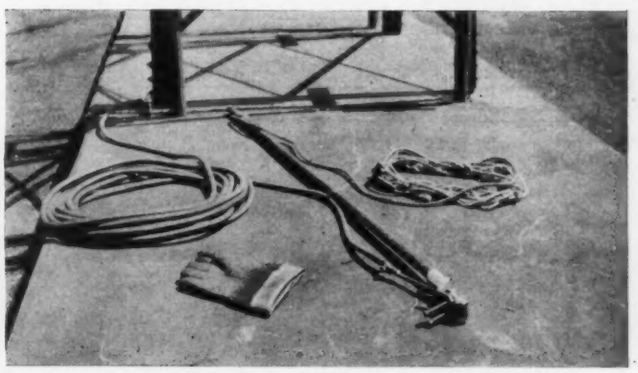
1. The mechanical and electrical operation of the breakers, otherwise dormant, is secured.
2. There is no doubt as to where the fault occurred when the breaker operations are analyzed in connection with these tests.
3. Observers at related points can secure reliable information that is otherwise lost under service conditions.
4. Knowing where the ground is placed permits the making of breakers non-automatic where imperfect conditions are suspected, and the relay operation can be observed without actually trying the circuit breakers.
5. Positive information as to the correctness of installation is secured.
6. Information as to the operation of oil circuit-breakers under service conditions is obtained.
7. The time selection between the various customers' loops can be observed. It should be noted that this time selection check included all the factors concerned in obtaining selection between stations.
8. Training in complicated switching operations is secured.

High-Voltage Tests Simpler

The experience obtained during these tests proved invaluable. The tests made on the 66-kv. lines differ somewhat from those conducted on the 22-kv. lines, being much simpler on the higher voltage. A piece of rubber-covered wire with clamps, hook stick and ground rod and the necessary measuring instruments and the observers were all that were required.

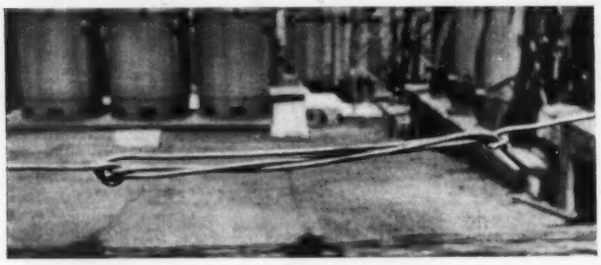
The ground lead is connected by a clamp on the end of the live line connector. The lead is taped part way out on the stick to make it swing free of the circuit breaker. The end of the stick is strained to a steel tower with a rope. This also assists in keeping the lead free of the circuit breaker. The station ground is used as a ground point. When the circuit breaker illustrated is closed, it will apply a ground to the line which will be cleared at the adjacent station, since the ground





Equipment used for 66-kv. line relay tests and close-up view of 66-kv. grounding material utilized in these determinations

is connected to the bus side of the circuit breaker. In order successfully to apply ground to a 22-kv. network an old circuit breaker was necessary. Had it not been used, it would have been necessary to remove equipment from service and open customers' loops so that service conditions would not have been properly simulated. Hence, this breaker, together with the control



Method of taking up slack in a grounding lead to keep it free of the ground

battery and the miscellaneous tools and wiring, was mounted on a trailer and transported from place to place, where it was desired to install the ground connections. In this manner 293 grounds were applied to the 22-kv. system and all 22-kv. breakers checked for relay operation. Where it was not possible to permit the breaker to open because of service requirements, a lamp was placed in series with the trip coil and its operation observed.

In the 22-kv. tests it will be noted that there are two low-voltage regulators used for high-current tests on current transformers. In the center of the trailer is a tool box which contains the necessary insulators, rope and miscellaneous auxiliary test equipment. On the other end of the trailer the 22-kv. circuit breaker is mounted. The storage battery is mounted under the trailer in a compartment.

Valuable Results Obtained

Valuable operating data were secured from these tests. After the tests were concluded, it was definitely known that the polarity of all ground relays and phase relays was correct. The mechanical and electrical features of the oil circuit breakers were given a thorough trial and it was definitely determined that they had been given adequate maintenance. In addition to the operating data obtained, certain inherent characteristics of design both in transmission layout and relay scheme applications were discovered. These characteristics were of sufficient importance to cause a change in the future plans for high-tension transmission rearrangements.

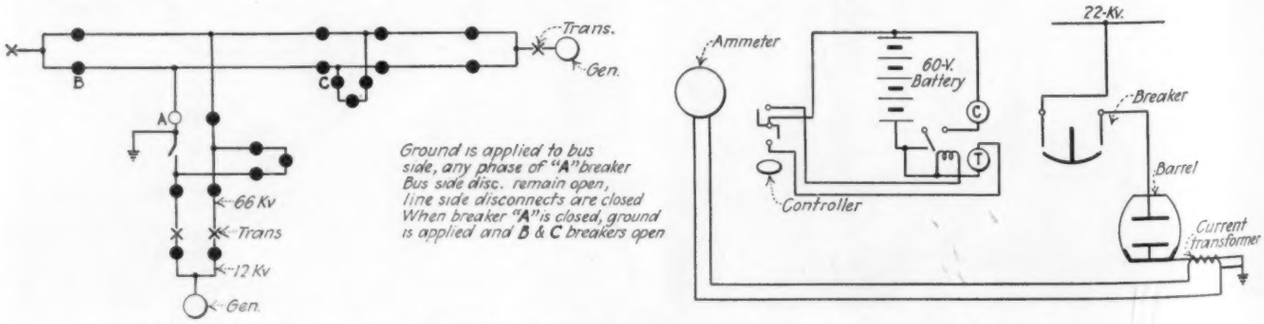
The greatest amount of satisfaction was secured from the ease with which these tests had been performed, particularly on the higher voltage. It was discovered to be a simple matter to apply the ground wire on the oil circuit breaker between the bushings and open disconnect, then to close the breaker and take readings. In view of the ease of testing relays and relay schemes, and in view of the benefit derived from this method, it is planned in future to check all new installations before they are cut into service. Also, a periodic check will be made on the entire system probably once every two years, and all questionable operations will be investigated by applying actual grounds to the assumed fault which caused the doubtful operation.

Illumination from Invisible Sources of Ultra-Violet Light

SOME unusual illuminating effects have been produced by using ultra-violet light to cause luminescence of objects and surfaces. For example, at the last convention of the Associated Edison Illuminating Companies figures of animals, balloons, dishes, fish, flowers and water in large pools were made to glow red, pink, yellow, green and blue in apparent darkness by the ultra-violet stimulation of chemical coatings. In addition experiments have been reported in which attempts have been made to produce subdued lighting effects, such as are needed in auditoriums, theaters, etc., to permit seating or exit without disturbing performances.

The popular demonstration of this interesting application of ultra-violet light was made under the supervision of L. C. Porter of the Edison Lamp Works. He reports that powerful searchlamps were used for the purpose, equipped with quartz-tube mercury-arc lamps. These sources of invisible radiation were used because they generate a much higher percentage of ultra-violet light than do ordinary forms of illuminants. Aluminum reflectors were employed because the ordinary silvered surface reflector, which reflects about 95 per cent of visible light, would reflect only about 15 per cent of ultra-violet radiation. The polished aluminum reflectors reflect about 45 per cent of the ultra-violet radiation.

To provide illumination of different colors chemical coatings of zinc sulphide, anthracene, fluorescein, rhodamine, eosin, etc., have been employed. Such chemicals absorb the short invisible ultra-violet radiations and convert them into longer visible radiations which become apparent as light. Some of the chemicals will glow only while they are being stimulated. Others will continue to glow for a little while after the ultra-violet stimulation ceases.



Schematic diagram for a typical 66-kv. test and connections for portable equipment used in securing data regarding relay operation on 22-kv. circuits

Industrial Power Interchange

Economical utilization of byproduct power can be worked out jointly by power and manufacturing industries to conserve the energy that is now wasted in many manufacturing plant processes

An Interview With

T. O. KENNEDY

Vice-President and General Manager Ohio Public Service Company, Cleveland, Ohio

POWER companies in their service to industry are meeting with an important economic problem which resolves itself frequently into both the sale of electric energy to and its purchase from the same industrial customer. This condition may be found most often in highly industrialized areas, but may occur in any territory served by electric utilities. That an arrangement for the sale and exchange of power between the utility and the industrial plant can be worked out on a mutually profitable basis has been shown in the experience of T. O. Kennedy, vice-president and general manager of the Ohio Public Service Company, under whose direction this company has been exchanging power with two of its large customers for some time. As this practice opens up large possibilities for the further electrification of industry and development of the sale of power by the central-station companies, Mr. Kennedy has been asked to outline the principles of such an arrangement. The philosophy and economics of the problem as regards industrial and utility problems have been stated by Mr. Kennedy as follows:

T. O. Kennedy

"There is a mutuality of interest between the manufacturing industry and the public utility industry.

"The payroll of the manufacturer supports the community and a part of this payroll naturally goes to pay for utility service. The public utility companies serving the communities are, therefore, vitally interested in the continuing success of the manufacturer, even though they may not sell him service.

"The manufacturer is also directly concerned in the prosperity of the utility companies whether or not he buys their service for his manufacturing processes. His successful operations depend, in a large measure, upon the living conditions provided by the community for his employees, and these living conditions are of course largely influenced by the utility service available for their use and convenience.

"In the conduct of some manufacturing businesses byproducts are produced representing energy in some form such as waste heat, coke, wood waste, coke-oven and blast furnace gas, etc.

"In the interest of the stockholders and in the interest of the community, these byproducts must be utilized to produce the greatest economic return possible, and because of the interdependence between the manufacturer and the utilities such utilization of these by-products becomes a mutual problem.

"Assuming that the above premise is accepted by the managements of the manufacturing company and the utilities, the first step in the solution of a byproduct situation is to canvass all possible uses for the byproduct in question carefully.

"The production of power through the use of byproduct fuel is probably the most uneconomic use to which such byproducts could be put. This is true because of the many important items of power cost, aside from the bare cost of fuel and also because of the low fuel prices against which the byproduct fuel must be evaluated.

"Therefore, every effort should be made to discover a more economic use for the byproduct, such as, for instance, for industrial heat processes, especially when the byproduct is in the form of gas and where the opportunity exists for such application. Probably the most valuable use to which coke-oven gas can be put is its distribution to domestic consumers through the mains of the public utility supplying gas service to the community in which the plant is located.

"There are many instances, however, in which the only use for byproduct energy is the production of power, and it is in such instances that the importance of cooperation between the manufacturer and the electric utility is emphasized.

"In general, there are two ways in which to consider the utilization of byproduct fuel for power production: (1) The installation of equipment designed for operation only when byproduct fuel is available and to utilize all such fuel. (2) The installation of equipment in sufficient capacity and number of units, equipped with aux-

iliary fuel-burning apparatus, so that a reliable and adequate supply of power can be produced at all times, whether or not byproduct fuel is available.

"In the second case the investment is very much greater than is necessary for the first method and, in addition, a wastage of byproduct fuel almost always results, because power requirements are at times insufficient to utilize all the byproduct fuel available.

"Plan No. 1 can only be followed by maintaining a connection with the lines of the electric utility on a basis permitting the taking of power from, or delivering power to, the utility system, depending upon the amount of byproduct power produced being less or greater than the total power requirements of the manufacturer.

"A comparison of the two plans in any particular instance narrows down to a study of the economics of power production by the utility and by the manufacturer with purchased fuel, and then superimposing upon the result of this study the greater relative value of the power produced by byproduct fuel when a connection is maintained with the electric utility.

Production Cost Advantages

"Most electric utilities today take advantage of many conditions contributing to lower total cost of power production which are not available to the individual manufacturer operating his own generating plant, such as:

"1. Location of plant adjacent to fuel and condensing water supply.

"2. Increased efficiency due to maximum size of units, use of high steam pressure and temperature.

"3. Decreased investment per unit of capacity by reason of interconnection of transmission systems, thus decreasing investment for reserve.

"4. Diversity of load resulting in high load factor on generating stations.

"5. Large station capacity justifies technical ability in operating force, insuring maximum efficiency of operations.

"It would indeed be a very unusual situation where a mutually advantageous interconnection contract could not be formulated between the electric utility and a manufacturer who produces byproduct fuel for which no better use could be found than power production.

"In this connection it is important that consideration be given to possible future developments in the industrial field. Due to the increasing use of electricity for power and heating processes, the manufacturer usually can anticipate a constant increase in his power requirements. On the other hand, it may reasonably be expected that the production of byproduct fuel will decrease as improved processes are developed, such as the direct production of iron from ore without the use of the blast furnace.

Economies in Steel Industry

"Many manufacturers, particularly in the steel industry, are today utilizing their byproducts very uneconomically, because, at the time they installed their power-producing equipment, they had waste fuel largely in excess of their power requirements and little attention was given to the efficiency of its utilization. Now, with greatly increased power requirements, they are burning purchased fuel during normal operating periods and are letting byproducts go to waste several hours every day and all day on Sundays and holidays.

"In 1922 a blast furnace company in our territory completed the installation of a 600-ton blast furnace and installed one 6,000 and two 1,000-kw. turbo-generators, using steam from boilers fired with blast furnace gas as fuel. Some of the boilers are also equipped for burning coal as an auxiliary fuel. Our company entered into an agreement with the furnace company to purchase all the power so generated in excess of that required to operate the furnace and its equipment. This contract was dated March, 1922, and the rate was based on the generating cost at our nearest plant for each month during the life of the contract.

"A steel company located adjacent to the furnace company, and under joint ownership, purchases at our regular filed rates all power for the operation of its plant, having a demand of approximately 20,000 kw.

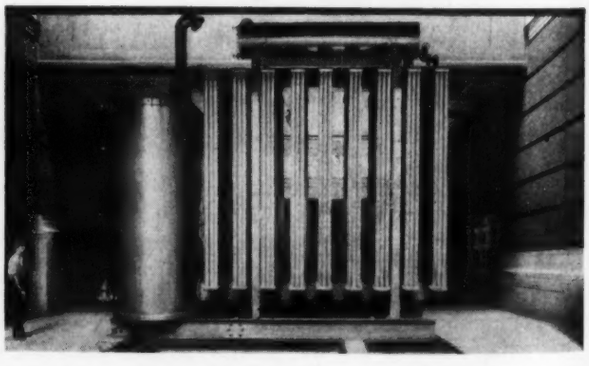
"In 1925 another steel company, at a different location, completed the installation of a 600-ton blast furnace and installed one 10,000-kw. turbo-generator, operating on steam produced from boilers fired by blast furnace gas, with auxiliary equipment for burning powdered coal. We entered into an agreement in May, 1925, to purchase all of the electric power generated by the 10,000-kw. turbine in excess of the requirements of the blast furnace and steel mill and to pay for such energy a flat rate per kilowatt-hour, which is practically equivalent to the generating cost in our system.

"The latter steel company has a total power demand of approximately 15,000 kw. and contracted to purchase at our filed rate all power required in excess of that generated by its own 10,000-kw. turbine.

"The relations between these two steel companies and our company are apparently satisfactory, and while I could not go so far as to say that the arrangements conform strictly to the ideals set up here, I believe that we have made a good start toward the working out of such an economic arrangement.

"The manufacturing industry and the utility industry have everything to gain and nothing to lose in putting all their cards on the table and working out the right solution to this problem of byproduct utilization in every instance."

Transformer Radiator Mounting That Saves Space

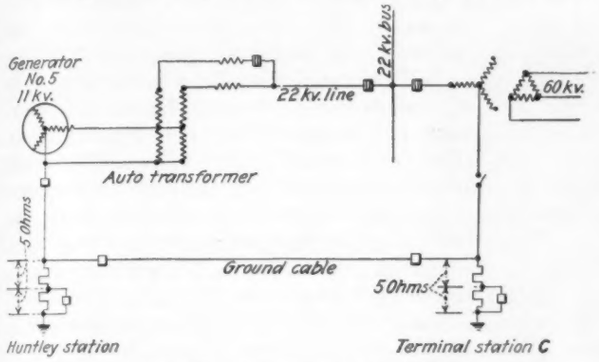


SPACE limitations in a station of the Brooklyn Edison Company required that the oil-cooling radiators for the generator auto-transformers be mounted as shown. The radiators are arranged face to face in a row, with manifolds connecting the upper and lower openings with the transformer tank. The conservator, mounted above the cooling units, is piped to the radiator furthest from the main tank. These 29,667-kva., single-phase, 13,800/27,600-volt transformers are direct connected to the generators.

New Buffalo Unit Feeds 22-Kv. System Directly

By Cromwell MacIntosh
Assistant Electrical Engineer Buffalo General Electric Company, Buffalo, N. Y.

IN PLANNING the addition of a block of 60,000 kw. to the distributing system, consideration was given to the fact that the 11,000-volt system was shrinking as the 22,000-volt system enlarged. It was, therefore, determined that the new turbo-generator should feed the 22,000-volt system directly. Accordingly the generator was designed for operation in conjunction with a three-phase auto-transformer, rated 66,667 kva., 12,000 to 22,500 volts, 25 cycles. This transformer was constructed in a single unit and is one of the largest capacity transformers ever built. The low-tension winding is solidly connected to the generator terminals without switches of any kind and the high-tension windings feed directly into a 1,250,000-circ.mil line extending to terminal station "C," making connection through circuit breakers and disconnecting switches to the duplicate 22,000-volt buses of that station.

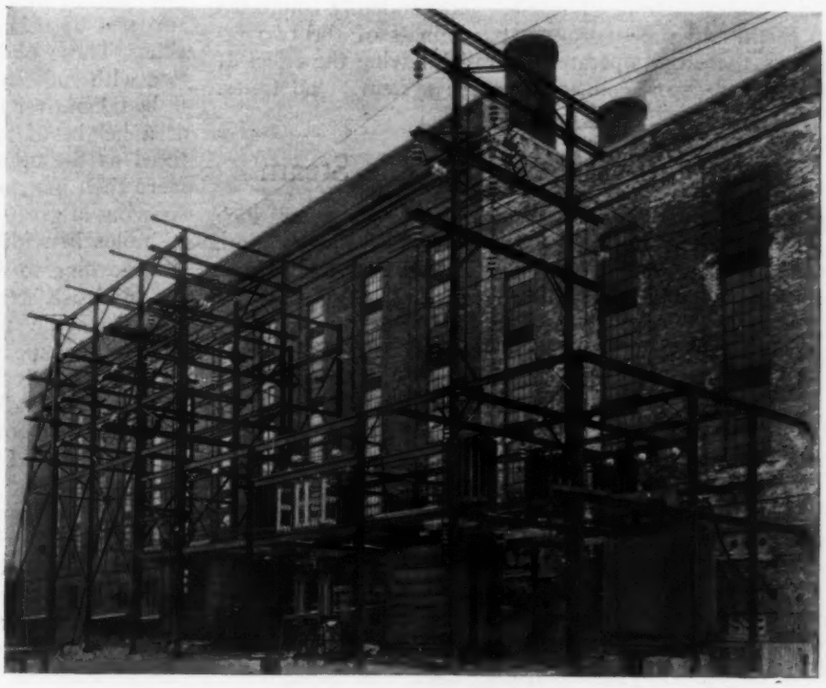


Generator is direct-connected to 22-kv. system through auto-transformers

The addition of so large a unit to the sources of energy already connected to the 22,000-volt distributing system, centered at terminal station "C," very materially increased the calculated short-circuit strains upon the system, and a means had to be devised to keep these strains within short-circuit ratings of the equipment already in service. To accomplish this end the auto-transformer was designed with two parallel windings permanently connected together at the neutral and at the 12,000-volt taps. One set of 22,500-volt terminals connects through 5 per cent reactors directly to the tie line. The other set of 22,500 terminals connects through similar reactors and an oil circuit breaker to the same line. The oil circuit breaker, known as the "reactance breaker," is operated by instantaneous overload relays set to trip when the generator output exceeds 300 per cent of its rated current. With both windings connected the auto-transformer has an impedance of 3.8 per cent on 66,667 kva. When the reactance breaker trips and thereby disconnects one high-tension winding in each phase, the impedance of the auto-transformer is changed to approximately 18 per cent on the same capacity. This large increase in impedance comes into the circuit before any circuit breakers have tripped at terminal station "C," with the exception of a bus junction breaker, which has ample rupturing capacity. When the reactance breaker opens it leaves generator No. 5 synchronized with the load, and as soon as the initial disturbance has passed the operator at the Huntley generating station recloses the reactance breaker.

In the 40,000-kva. tie between the 11,000-volt system and the 22,000-volt system a similar reactance breaker has been installed, which disconnects the high-tension winding of one of the two 20,000-kva., three-phase transformers, operating in parallel. The effect of this reactance breaker, therefore, is to double the impedance of the tie from its value of 10 per cent as computed on a 40,000-kva. basis.

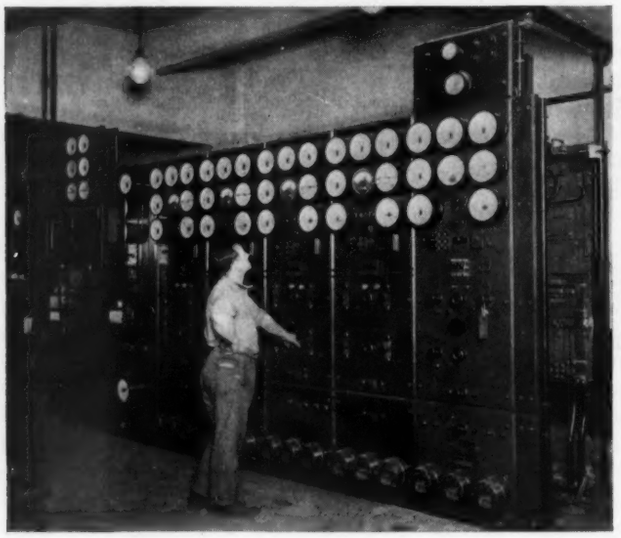
With respect to metering and protection, generator No. 5 is considered to include its auto-transformer, located just outside of the west wall of the station, its reactors and reactance breaker, tie line and switching equipment at terminal station "C," through which it is connected to the load bus. All of this equipment is protected by induction relays served by differentially connected current transformers installed in the neutral lines at the generator and in the conductors between circuit breakers and load bus at terminal station "C." Connected to the 12,000-volt generator terminals is a feeder for supplying house service. Since this connects within the zone protected by differential current transformers and relays, it is necessary to compensate for any current taken. Consequently, it has current transformers connected in parallel with those of the main tie line In addition to the differential protection just described, the output



66,667-kva. auto-transformer, power-limiting reactors and 20,000-kva. transformers

of the generator is controlled by overload induction relays located at the terminal station.

The 22,000-volt distribution system is equipped throughout with induction relays of the usual kind and with ground or neutral relays arranged to trip instantaneously on ground current. Relay settings are calculated on the basis of a maximum ground current of 2,540 amp., which is the current that will flow through a 5-ohm ground resistor, connected to the neutral point of a 22,000-volt system, when one phase is dead grounded. In order to insure correct functioning of these neutral relays, the system ground must have a value of 5 ohms at all times, whether or not the generator is connected to the load.



Generator control panels, generator-transformer unit on right

Consequently, an independent ground resistor could not be used. The scheme adopted uses two 10-ohm grounding resistors, one at the terminal station "C" and one at the Huntley station. These are independently connected to earth, and the ungrounded terminals of the two resistors, therefore, operate in parallel, having the effect of a 5-ohm resistor, connected to the system at all times.

New Station Uses 1,350 Lb. Steam

STEAM will be generated at 1,350 lb. per square inch pressure in the new Deepwater (N. J.) station, owned jointly by the American Gas & Electric Company and the United Gas Improvement Company. The Babcock & Wilcox Company supplied the four standard and two reheat 1,350-lb. pressure boilers. The standard boilers with steaming economizer and air preheater will produce 331,000 lb. of steam per hour at 725 deg. F. The reheat boilers will deliver 290,000 lb. of steam per hour and will reheat 419,000 lb. of steam to 775 deg. F.

Generating equipment, as reported on page 476 of the ELECTRICAL WORLD for March 3, 1928, will consist of an initial capacity of 118,500 kw., the entire steam demand being supplied by the high-pressure boilers. Operating pressures will be 1,200 lb. per square inch at 725 deg. F. total temperature. This plant will also supply process steam to the adjacent plant of E. I. du Pont de Nemours & Company, Inc. The design and construction of the new plant is under the supervision of Stevens & Wood, New York.

Seaplane Aids Line Right-of-Way Survey

IN SURVEYING the right-of-way for its 200-mile, 220,000-volt transmission line from the Ottawa River to Toronto, the Ontario Hydro-Electric Power Commission used a speedy seaplane. The aerial survey was adopted, in preference to a preliminary field survey, because it was considered cheaper and quicker, and more readily assured the best possible location of line. The eastern 120 miles of line passes through rough, undrained lake districts. A straight, short, easily constructed line avoiding villages, farms, buildings and orchards was desired for the western 80 miles.

The first procedure was to project and locate the general route. Practically the only maps available were the township maps and the standard government topographical maps. These were found to be unreliable in detail. Instances were noted, through the aerial survey, where lakes were half a mile from their map location. Many lakes were not mapped at all and roads indicated on the map did not exist. Without accurate information regarding the physical obstructions existing along the 120 miles of rough and isolated bush country the work of any survey parties put in the field would have been slow and expensive, involving general triangulation with traverses to locate obstructions and the running of trial lines.

A seaplane, equipped with pontoons, and having a flying speed of 100 miles an hour, was engaged through an aerial survey company. On the eastern section of the line, and as far west as Rice Lake, there are lakes within gliding distance of the center line, but from Rice Lake to Toronto there are few suitable landing places for a seaplane, and as the machine did not carry sufficient gasoline for a flight to the company's Ottawa River base from Toronto after a photographic flight, a base was established near the center of the route.

The survey company was provided with a copy of the government map showing the projected center line and two sets of oblique photos were taken, one from either side. These obliques were used to locate or revise the line with sufficient finality to allow vertical photographs to be taken over the final location. The latter were made at a height of approximately 6,000 ft. over what was fixed as the approximate final location of the line and were then matched into mosaic strips about 22 in. long, showing in great detail a strip of country averaging some 1¼ miles in width.

According to A. P. Goodwin of Toronto, engineer of the Hydro-Electric Power Commission transmission department, the use of these pictures has practically eliminated expensive preliminary field surveys and the work of line location has been facilitated. Small hilltops, ridges and gullies washed by rainstorms can be discerned without difficulty.

By the use of aerial maps the commission's right-of-way agents have been able to go out into the fields and secure options or easements without any preliminary field work. It has been possible to show clearly to the various owners the location of the proposed line without going out and tramping all over the fields.

The only work for the field parties, according to Mr. Goodwin, was the location of the line on the ground as indicated on the photographs, the running of a profile along the center line, noting property ties and ownership of land passed over and the staking of the tower sites.

Five Years of Stock Dividends

Method adopted in 1923 proves beneficial both to shareholder and to the company. Comparison with issue of rights and financial results of the two policies over a period

By Frank L. Dame
President of the North American Company

OUR policy of paying dividends exclusively in stock during the past five years has demonstrated in a rather conclusive manner that such a policy is both practical and advantageous. That the benefits are enjoyed both by the shareholders and by the company has been proved by the experience of this company and by the indorsement of investors in every part of the country.

Many articles have been published within the last two or three years on the subject of stock dividends. Such articles usually express the academic viewpoint that the stockholder retains the same interest in a company or corporation that he had before the issue of such dividends. Sustaining this view, the United States Supreme Court has held that such dividends are exempt from the income tax. Aside entirely from the legal aspects of the question, I am greatly impressed by the facts established by actual experience with stock dividends during the period since 1923.

Frank L. Dame

While there is a wide variation in practice in the payment of stock dividends, I shall refer here only to those dividends which are declared regularly and in the place of cash dividends. As already intimated, common stock dividends of the North American Company have been paid entirely in common stock since 1923. I am not familiar with any other company following this procedure, although in some cases an option is granted between the payment of cash or stock.

Advantages of Stock Dividends

There are certain outstanding advantages of the policy of paying stock dividends. It provides a not too costly method of financing, which is not especially burdensome to the stockholder, to meet the demands of steady expansion, and is especially adaptable to the public utility industry. Furthermore, payment of stock dividends provides a satisfactory return to the shareholder—maintaining his proportionate interest in case he holds his dividend stock, or, in case he sells the stock, the equity in a growing and stronger concern is safeguarded. The policy also enables the shareholder to choose between cash and investment, the former by immediately cashing his stock dividend, which is readily marketable without loss except the relinquishment of potential profits, the latter by keeping his stock dividend and retaining his proportionate interest with potential profits. The second option is the retirement of dividends and interest. The stockholder can do this without the payment of additional funds, a course which so often is necessary in exercising rights to subscribe to stock. In brief, the stock dividend facilitates an increase in investment holdings without imposing additional financial burdens on the stockholder. His interests are completely protected in the interval, while he has the option of automatic reinvestment or a payment in cash.

The charge that the stock dividend is a means of tax evasion is obviously unfounded, since the company paying such dividends receives no immunity. The North American Company has adopted the stock dividend policy since it automatically makes available a fair part of the company's necessary investment funds for subsidiary development without adding an undue burden to shareholders. For taxation purposes the government recognizes original cost and stock dividends bring down the average. If the dividend is marketed, any profit over the average cost is taxable to the individual. It is essential for the holding company to increase its investments in the equity stocks of its subsidiaries in order to maintain a balanced capital set-up which will enable the parent company as well as its subsidiaries to secure money from the sale of preferred stocks and bonds at the most satisfactory rate; particularly is this the case in the public utility industry in view of its exceedingly rapid growth, doubling as it does on the average about every five years. The stock dividend of this company, namely 10 per cent, requires about seven years to double.

The strengthening of the financial set-up of the North American Company since its adoption of the stock dividend policy five years ago is evident. The dividends issued have not increased the common stock outstanding in proportion to the total consolidated capitalization. In fact, there has been an actual decrease. Furthermore, common stock during the period March 31, 1923, to Dec. 31, 1927, increased 66.6 per cent from stock dividends and 33.6 per cent from the issue of stock for cash and for properties, making a total increase of 100.2 per cent.

Meanwhile the consolidated net income, which is the amount available for common stock dividends and surplus, increased 158 per cent, or more than 1½ times the total increase in common stock.

A comparison of the stock dividend policy with the issue of rights to stockholders from time to time to subscribe for additional stock, usually at par, is interesting. The regular payment of stock dividends is virtually the equivalent of combining cash dividends with subscription rights; the former, however, gives the stockholder more frequent and convenient subscription privileges. The investor who is so situated financially that he cannot subscribe for 10, 15 or 25 per cent of his holdings, as the offering may be, sells his rights willingly and counts the proceeds of the sale in addition to his cash dividend as his yield from the investment. Investors frequently seek stocks on which rights may be expected regularly in order that they may market them immediately. Other investors buy stock with the intention of exercising rights and obtaining additional stocks so offered at a slight advantage over the market value. This is really a matter of investment rather than of taking profits, since the stockholder buys stock at less than the market price and has a potential profit at once.

Illustrating the comparison between the stock dividend and the subscription rights method is the following list of well-known public utilities which have adopted the policy of paying dividends exclusively in cash and issuing rights generally at par. The table, based on statistics in *Moody's Manual,* shows the percentage increase in stocks during the four years ended Dec. 31, 1926:

	Stock Increase, Per Cent
American Telephone & Telegraph Company	52.2
Brooklyn Edison Company	164.2
Commonwealth Edison Company	81.3
Detroit Edison Company	147.7
Pacific Gas & Electric Company	52.2
Southern California Edison Company	15.8
Arithmetic average	85.6

It is interesting to compare this average with the North American Company's stock increase, which was 100.2 per cent to the end of 1927 and 94 per cent during the four-year period used in the table, and for the purpose of a fair comparison it must be pointed out that the above table includes in some instances increases contributed to by such matters as conversions during the four-year period of bonds and debentures issued prior to the period; also, such conversions, although resembling rights, may or may not have been offered to the shareholders, and if not they decrease his proportion of interest in the company. In the case of at least two of the above companies the issue of rights is explained clearly in *Moody's Manual.* If a stockholder exercised his right 100 per cent the following would have occurred:

1. The Commonwealth Edison Company offered to its stockholders 20 per cent stock rights exercisable in February, 1923; 20 per cent in May, 1924; 12½ per cent in May, 1925, and 12½ per cent in August, 1926, which increased the stockholder's $100 interest to $120 in 1923, $144 in 1924, $162 in 1925 and $182.25 in 1926. In exercising these rights the stockholder subscribed for $82.25 additional stock. Meanwhile, he had received 8 per cent cash dividend, $32 on his original stock and $13.37 on his new stock, a total of $45.37. Thus in exercising his rights to buy $82.25 additional stock at par he had to pay $36.88 in addition to reinvesting the $45.37 received in cash dividends.

2. The Detroit Edison offered 25 per cent stock rights in June, 1923; 25 per cent in June, 1924; 10 per cent in October, 1925, and 10 per cent in December, 1926, which increased the stockholder's $100 interest to $125 in 1923, $156.25 in 1924, $171.87 in 1925 and $189.06 in 1926. In exercising these rights the stockholder subscribed for $89.06 additional stock. Meanwhile, he had received 8 per cent cash dividend, $32 on his original stock and $14.97 on his new stock, a total of $46.97. Thus in exercising his rights to buy $89.06 additional stock at par he had to pay $42.09 in addition to reinvesting the $46.97 received in cash dividends.

It is obvious that in either of these cases the additional stock purchased at par would have a market value today of more than 75 per cent above its cost. In order to maintain his proportion of interest in the company the stockholder was obliged to exercise all subscription rights offered him and to reinvest not only his cash dividend but an additional amount of cash. The stockholder of the North American Company, on the other hand, by retaining the new stock which he receives in the form of dividends maintains his proportion of interest in the company without additional investment. His new stock, of course, represents an increase in return in accordance with its enhanced market value.

Does Not Reduce Equity

As the North American Company sees it, the problem is to provide required capital without reducing the strength of the stockholder's equity, either by offering stockholder subscription rights to new stock or by payment of dividends in stocks. The plan adopted, which makes the situation easier for the stockholder, is to issue stock quarterly for the amount of the dividends and either to send the stock to the stockholder or sell it for him, as he chooses. In our opinion it is more convenient for him to know that this will be done quarterly at the rate of 2½ per cent than to have 10 per cent or more in rights offered in one block at irregular intervals, when he would probably not be in a position to buy it.

A huge amount of new capital is required annually to take care of the normal development of the public utility industry and of a public utility company. This amount is from four to six times the increase in gross revenue during the same period. It is therefore my opinion that the policy of paying dividends on the equity in stocks is adapted admirably to the public utility industry, since its consistent and rapid growth requires so large and constant an increase in equity capital to keep the financial structure well balanced to facilitate senior financing.

System Routine in Emergency Switching

By C. P. Hubbard
Chief System Operator Detroit Edison Company, Detroit, Mich.

ALL GENERATING station and substation operators in the Detroit Edison Company system are thoroughly drilled in procedures to follow in case of system emergency. These standing instructions, which are revised from time to time in the office of the system operator, include definite orders applying to the system in general and to the local plant or substation in particular and action which can be taken by operators without first

notifying the load dispatcher. Notification of the load dispatcher is required at the earliest possible moment. Code signals sent simultaneously to all stations by the load dispatcher over the private telephone system assist in handling system emergencies.

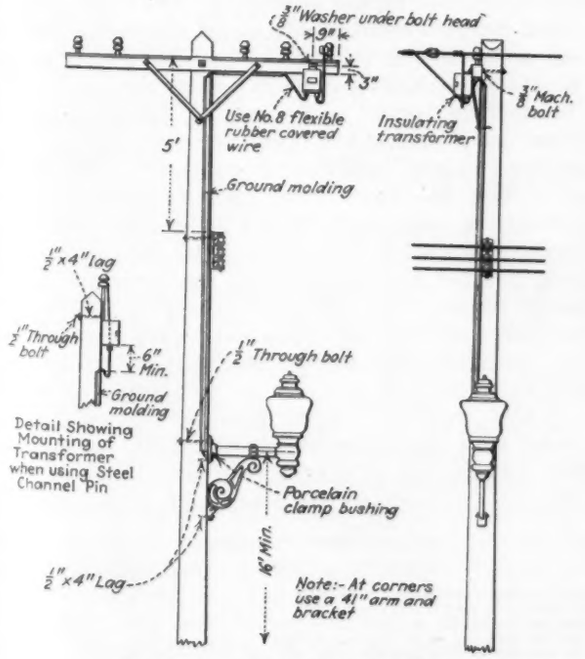
Orders which are simultaneously transmitted to all stations apply in most cases to direct-current distribution, the power-line system and street-railway supply. The code employed is indicated below:

1. Three short rings and one long ring on private telephone—close all direct-current distribution feeders and pick up load on motor-generator sets.
2. Double three rings—open emergency power lines.
3. Four short rings—lower potential to 400 volts on street-railway generators.

In case of interruption of an incoming line feeding station apparatus the operator immediately restores the apparatus to operation by putting it on another line. He does this before notifying the load dispatcher. The operator will not take this action, of course, if it is patently apparent to him that the cause of the interruption lies in the local apparatus. He does it only if he is reasonably sure that the trouble is outside of the station, which in most cases it is. It is the responsibility of the operator to be fairly sure that offending apparatus in the station is not going back on a good line and thus continuing the trouble. In view of the necessity for maintaining reliable service this practice is regarded as justifiable and safe.

In emergencies that affect supply to customers at primary and higher potentials, these customers do not get into direct communication with load dispatchers or station operators. It is a company rule that customers' calls shall be handled by the general trouble board. This board has positions occupied by experienced men who are familiar with the distribution and transmission systems and with system operation procedure. These men are more competent to deal with the customer who is affected by system trouble than is the load dispatcher who is working at high pressure in an emergency.

White-Way Street-Lighting Fixtures on Wood Poles

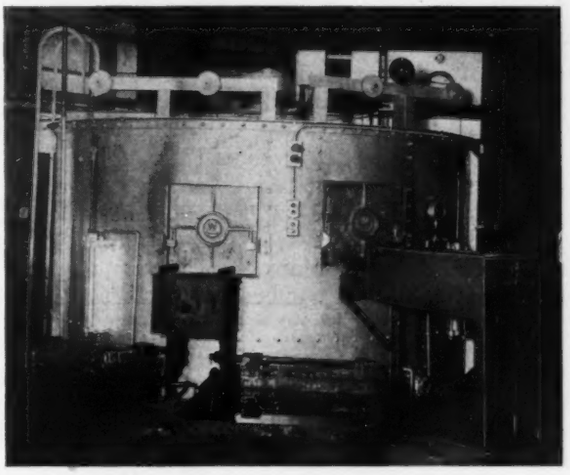


Standards of West Penn System

Automatic Furnace Permits Accurate Heat Control

By W. J. Diederichs
Industrial Heating Engineer
Westinghouse Electric & Manufacturing Company

THE application of an electric rotary hearth furnace to the hardening of drop-forged wrenches has resulted in improvements in the quality of the products. These wrenches vary in size, requiring a large variation in heating time, and are treated in quantities of 1,200 lb.



Automatic heat treating produces uniform products in this electric furnace

per hour regardless of the size. Warpage is a serious factor and individual quenching of the pieces is deemed necessary. It is also required, due to variation in size and analyses, that quenching be carried out at temperatures which vary from 1,400 to 1,575 deg. F.

The furnace provides an annular heating chamber 32 in. wide by 30 in. high, the floor of which consists of a rotating hearth covered by alloy plates elevated above the brickwork of the floor. The hearth is motor driven and is normally stationary. The control of this drive is such, however, that at regular intervals the hearth is automatically advanced the distance between the charging and discharging door and stops. The furnace has been equipped with a special charging device which, as shown in the accompanying illustration, is located in front of the charging door at the right. This device places a definite weight of work on the hearth each time it is operated. The hearth remains stationary while a new charge is entered and while a properly heated charge is individually and manually quenched at the discharging door. The time which the hearth remains stationary is adjustable, and by this means the time the work remains in the furnace, subjected to heat, can be varied through wide limits. This permits the adjustment of the heating cycle to the size of the work to be treated.

The furnace has an electrical input of 126 kw. for operation on 110-volt, three-phase power supply. This input is divided into two zones, each occupying one-half of the annular chamber. Each zone is independently controlled by a separate pyrometer and thermocouple actuating suitable contactor panels. This two-zone arrangement of input permits adjusting the temperature being maintained in the ingoing and outgoing halves of

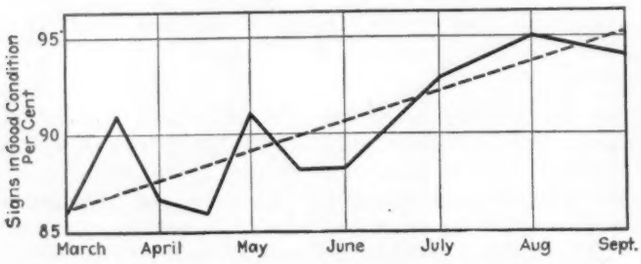
the chamber and makes it possible to vary the rate of heating the work in accordance with manufacturing and material requirements.

The furnace, when operating at a production of 1,200 lb. of work per hour at a temperature of 1,575 deg. F. successfully treats 9½ lb. of work per kilowatt-hour of energy consumed.

Electric Sign Maintenance Plan Increases Revenue by $2,000

AS A result of a nine months' experience with intensive efforts to improve the illumination of existing electric signs and floodlighted bulletins, H. L. Johnston, manager of industrial and commercial lighting Duquesne Light Company, estimates that an outlay by this utility of $300 for labor and material will have increased the revenue from this source by some $2,000 in the first year.

A survey of the electric signs in the most active sections of Pittsburgh indicated that a considerable percentage of these devices were not operating at their maximum efficiency. Many lamps were found to be inoperative, and in a number of instances signs were neither adequately cleaned nor painted to attract the desired attention. In order to maintain electrical advertising on a high level an effort was made to call the attention of the owners to the impaired effectiveness of the devices and to the desirability of restoring the equipment to a satisfactory condition. A total of 950 signs were listed in the principal business districts and inspection routes were planned, including approximately 125 installations apiece. Each route was then given to a man, who covered his assignment between 8 and 10 o'clock in the evening and who checked for burned-out lamps, inoperative equipment and other points involving poor conditions. Each route was checked twice a month until the summer months were reached, when the interval was lengthened to provide monthly inspection.



Electric sign operation improved as a result of periodic survey

A card with the name and location of the sign included a list of the major defects that might be involved: Part of lights out; all lights out; needs cleaning; needs painting; exterior lighted and interior lighted. Space for notation of equipment in good order was provided. Upon completion of the check, a card indicating conditions as found was sent to the owner.

At the time of the initial route coverage, only 87 per cent of the signs were estimated to be in first-class condition. Two weeks later a 91 per cent satisfactory condition was observed. Subsequent checks, while not meeting with the same effective response, indicated a general improvement until it was necessary to send cards regarding but 5 per cent of the signs surveyed.

Cost of Electric Cold Storage in Farm Dairies

RESULTS of electric refrigeration as compared with natural ice on three retail dairy farms over a period of from two to four years each have recently been summarized by the New Hampshire Agricultural Experiment Station (of the University of New Hampshire) for the New England N.E.L.A. committee on the application of electricity to agriculture. On these farms the storage rooms ranged in size from 170 to 207 cu.ft. The refrigeration equipment was the same in each case with the exception of the motors, which were either ⅓- or ¼-hp., and the compressors were two-cylinder, reciprocating, air-cooled, gear-driven units using methyl chloride as a refrigerant. Initial investments for mechanical refrigeration equipment ranged from $350 to $766.50. The former was on a rental basis, which has been discontinued, so that from $770 to $775 is now required. For the natural ice method the initial investments varied from $135 to $775. The average for all refrigerating methods amounted to $455.

Yearly fixed charges are generally less for the natural ice method. Cash expenses for operating electric refrigerating units varied from 17 to 52 per cent less than for natural ice, but in one case were 12 per cent in favor of the electric method. The storage rooms were designed to carry an average load of 300 qt. of bottled milk per day and a maximum of 420 qt. has been stored. The maximum outdoor temperatures met were 102 to 104 deg. F. in the sun, at which time the cold storage was 50 deg. on one farm and 44 deg. on another. The average cold storage temperatures for these farms was 43 deg. for a year when the outside temperature averaged 62 deg. An average difference of about 20 deg. was maintained. The equipment operated 50 per cent of the time on two farms and 40 per cent on the third. Dairy cold storages consumed from 10 to 42 per cent of the electrical energy used on each farm for a year. The demand of the ¼- and ⅓-hp. motors under running conditions was from 320 to 360 watts and the maximum demand on starting was as high as 1,340 watts.

The energy consumption costs of the electrically operated units ranged from $37.31 to $75.60 per year on rates varying from 3½ cents to 7 cents per kilowatt-hour. The average for all years and all farms was $48.83. When using natural ice, operating costs (labor, ice and sawdust) ranged from $196.40 to $325.92, with an average of $236.56. Due to the almost complete elimination of labor the operating costs for the electric method were consistently less than for ice, the natural ice costs averaging 383 per cent greater than the electric bills. The energy consumption varied from 772 to 1,479 kw.-hr. per year, including both nine and twelve months' operation, and the total over-all electric costs ranged from $106.71 to $135.35 per year, or an average of $118.33. The total expense ranged from 67 to 140 per cent greater with natural ice and averaged 100 per cent more than the total cost of electric refrigeration.

On a total cost basis, the average of all farms was:

	Natural Ice	Electric Cooling
Cost per cubic foot of total contents	$1.19	$0.62
Cost per cubic foot of storage contents	1.32	0.69
Cost of 100 qt. milk per year	0.30	0.15
Cost per 100 qt. milk for period machine was run	0.51	0.25
Cost per cow per year	6.36	3.17

Some Experiences in Price Cutting

A close-up picture of the present tension in the market. Why the seller and the purchaser are at loggerheads

By Earl Whitehorne
Commercial Editor Electrical World

IN ANY discussion of the evils of price cutting, sooner or later the talk must get down to cases. It is perfectly natural and practical and proper for the purchasing agent to buy as cheaply as he can. And it is no less right for the manufacturer who sells the goods to get as profitable a price as possible. But in the evolution of business certain principles have developed and certain responsibilities. The trickery that once was the life and sparkle of horse trading is now frowned upon. Fair dealing has become the accepted standard in commerce, a live and let live policy that considers as satisfactory only a transaction that is of benefit to both contracting parties. The seller is supposed to give honest value and the buyer is expected to pay an honest price. Surely nowhere is this better understood and recognized than in this progressive, enlightened and prosperous electrical industry. Why, then, is there so much talk right now of trouble between large buyers and sellers? What has gone wrong in the market place that there is bitter talk of price cutting by manufacturers and profiteering by purchasers?

In a recent article entitled "Who Pays the Cost of Price Cutting?" Mr. Whitehorne discussed some aspects of the present buyers' market in the electrical industry. The purchasing agent is charged with profiteering by ingenious methods of beating down price levels. The manufacturer is accused of price cowardice. The result has been demoralizing in many lines.

Therefore it has been recommended that secrecy be eliminated wherever bidders are called upon to reduce a price after bids are in, and that the salesman should demand a showdown and not accept the mere statement that he is the high bidder.

Many letters of widely varying opinion and many recitals of personal experience have been received. This article carries the discussion further, with a more intimate picture of conditions involved on both sides of the bargaining.

Editor.

Tricks of the Purchaser

Study it a bit and you find an interesting thing. There are some manufacturers who have the courage to establish prices and maintain them. Their price is their price and they refuse to dicker. But there are some who lack the courage or the strength. And just so there are some purchasing agents who do not haggle. They ask for bids from suppliers whose product is acceptable and the low man gets the business. But there are others who seem to consider their function one of dollar squeezing, and the length to which this gentle art is carried is astonishing. By way of illustration let's just consider a few examples:

Case No. 1 — One very large company has a purchasing agent who seems to have complete control of the engineering department and his method is as follows:

The engineers confer with salesmen of various manufacturers and, after getting the needed information, issue specifications giving the amounts of apparatus desired, item by item. These are then turned over to the purchasing department and bids called for. The bids, when received from the manufacturers, go to the engineering department, are tabulated and analyzed. After this procedure they are handed to the purchasing department with the recommendations as to what the engineers would like. These engineers know what they want, but are required by the purchasing agent to give the names of at least three manufacturers whose apparatus would be acceptable, although the engineers, from an operating standpoint, would probably know definitely that one particular type of apparatus or one particular manufacturer would give the best results.

The purchasing agent then notifies the various bidders to appear at his office on a certain date, and the result is a flock of salesmen, the majority of whom never had a chance, but do not know it, as their names are not included in the engineers' recommendations to the purchasing agent.

The purchasing agent then retires to a large conference room and calls in his group of engineers—sometimes as many as 30. One by one the salesmen, those who have a chance and those who never had, are stood up before this imposing group. It is like a man at the bar facing a judge and jury. The purchasing agent, a very imposing individual, then holds up a bid, asking the trembling salesman if it is his. Admitting the charge, the purchasing agent barks out: "Is this your lowest bid? You have one chance to cut the price."

And so the bidding goes, until the harassed salesmen paint by telephone or telegraph to their main offices a story of the battle as they see it. Usually the story is utter defeat unless the price is reduced.

In a few hours each is called in to report again and given another last chance and somebody weakens. Then, after all this, the three representatives of the manufacturers selected by the engineers are again called in one by one. They are

then given another chance to cut the price, so one by one they are worn down and one of the three eventually weakens. The net result is that some manufacturer takes a loss; the two others are sore, revengeful and swear to get even the next time with this manufacturer to whom the business was awarded, usually overlooking the fact that the purchasing agent is the one they should swear at.

When the next negotiation comes up it is usually awarded to some one other than the first successful bidder, and this goes on year after year.

Case No. 2 — A practice more or less common in a large company is to issue calls for bids on a certain specification. After all the proposals are in, the purchasing department tabulates them, and calling in the bidders one by one, each is told or led to believe he is a little high in price. Finally one decides to meet or better the lowest bid submitted. All are in a roundabout way given an idea as to the amount of the lowest bid, told to get in touch with their factories and sharpen their pencils.

As a result, one or more of the manufacturers "bite" and come in with a still lower bid to "get in," as the salesman often says. This is especially true of some one who considers himself an outsider or has never been successful in securing business from this particular buyer.

When the purchasing agent has interviewed the entire list and held them on "hooks" for a time all the bidders are notified that the specifications have been changed by the engineers and new bids will be called for.

Practically all the time and expense of the first bids are thus lost and the merry-go-round starts all over again. Each one having spent considerable money by this time, some decide to go after the business hard in the hope of saving something out of the wreck. The net result is a free-for-all fight, but the business usually goes to the manufacturer whom the purchasing agent has had in mind all the time—at a lower price.

The majority of the bidders never had a chance, but were systematically used to beat down the price. This method of procedure not only costs apparatus manufacturers a great deal of time and money but also wastes time and money for the purchasing and engineering organizations who award the contract.

Case No. 3—Some purchasing agents insist on a lump sum price on all major electrical apparatus required on a job. This lump sum might include transformers, oil circuit breakers, disconnecting switches, air-break switches, switchboards, regulators, outdoor substations and cable.

There are very few companies in this country that are in a position to offer such a complete bid. The smaller or specialized manufacturers are at a disadvantage when the engineers favor their equipment for a certain portion of the work, but the purchasing agents insist on a lump sum bid.

In order to obtain the lowest price, the purchasing agent will often ask the larger companies the amount of reduction they will make in case a certain item is eliminated from the lump sum bid. In order to protect their lump sum bid the larger companies' deduction will naturally be less than it should be when in straight competition.

The smaller manufacturers who cannot bid on the entire specification, but who may have equipment more suitable for the work desired by the engineers, are advised by the purchasing agent that they can have a certain portion of the business by taking it at a figure equal to the larger companies' deduction on that item from the lump sum bid.

By this method the smaller manufacturers are therefore offered the business at a price very much under the normal price, and if one of them takes it he is quite apt to lose money. On the other hand, if refused the business the purchasing agent will tell him that he was high in price and the business went to one company on a lump sum basis.

Case No. 4—One large purchaser of apparatus has a purchasing department which has successfully carried out the following plan:

Bids are called for on, say, 21 items, all of which can be supplied by one of several manufacturers. The bids specify itemized prices and a lump sum proposition.

The purchasing agent carefully picks out from all the bids the lowest price on each item. One man may be much lower on item 7. The purchasing agent then makes up his own lump sum proposition. Should any of the bidders in their proposition state that on a lump sum basis they will give a further reduction of, say, 5 or 10 per cent, the purchasing agent also takes this off his own lump sum tabulation.

The manufacturers' salesmen are then summoned and each one in one way or another learns that the purchasing agent has a lump sum figure considerably lower than that quoted by the salesman, who quickly wires the factory. In some instances the salesman actually finds out the exact lump sum figure referred to.

The net result is, the purchasing agent, by setting up this artificial lump sum figure, generally succeeds in knocking down the price of the manufacturer with whom he intended doing business from the start or whose apparatus is really specified and wanted by the engineering department.

Case No. 5—In a recent purchase of a large order five manufacturers bid. One was very high and was counted out. Three were low. The purchasing agent sent for the other bidder who was next below the high and told him that his equipment was desired and offered to give this firm the order at a price to be set by averaging the three low bids and adding 10 per cent. This is an inaccurate way of establishing the value of electrical machinery, to say the least, but he took the order.

Case No. 6—A purchasing agent asked for bids on a number of large machines involving a considerable element of design and engineering. The purchaser's engineer stressed the need for the highest efficiency obtainable. Several bids were entered involving a large expense. The high man was told that he would have to cut so many thousand dollars if he was to get the order. The purchasing agent asked the salesman: "Why should you expect to get so much more money than the X-Y-Z Company for the same size machines?" The sales engineer said: "Mr. Pricer, there are very specific reasons, based on definite engineering considerations, why our machines are worth more money to you. But there is no point in my taking your time to go all over them because you are not an engineer and will not understand the values that I am talking about. But I will be glad to go all over it with your engineer. If I can convince him that our machines are worth that much more than the X-Y-Z, will you consider this added value as a factor in our bid?" And the purchasing agent said: "No, each company must be on a par and the price decides it." And that was that.

Typical Situations

The number and variety of these cases are without end, but certain typical situations stand out:

1. Where the purchasing agent gets the high bidder to cut on the indefinite promise of a large block of business next year.

To the Purchaser

INDUSTRY needs more intelligent buying. It needs purchasing agents who know the values of the equipment they buy and make of their function something more than an adroit matching of prices. It needs frank, open recognition of the fact that what is bought must be paid for and that bids which embrace elements of engineering and of service, as well as the delivered product, cannot be compared by a mere tallying of the total cost figures.

Therefore, the time must come—will come—when the purchasing agent no longer shall be rated for his penny-squeezing ability, but for his engineering skill in sensing and securing the greatest values for the money spent. And one of his greatest resources will be the good will and support of his suppliers.

2. Where the buyer lies, giving the bidder a false intimation as to his competitor's price, or representing the competing price on motors alone, for instance, as the complete price for motors and control, or citing a price on equipment that is not comparable, or ringing some other subtle change on the truth that deceives and tempts the manufacturer to cut.

3. Where the large buyer demands special discounts for large volume, claiming that this volume carries the manufacturer's overhead, and thus forces the big manufacturer's price down to where the small manufacturer cannot compete.

4. Where very large buyers of electrical equipment that is used as part of a manufactured product threaten to make their own motor or control or whatever it is unless the price is cut.

5. Where large utility holding companies argue that one of the savings possible through holding company operation should show up as savings in purchasing, and demand discounts over prices given to operating companies, which eliminate the small manufacturer and force the large manufacturer's price below the margin that provides for the further development of bigger and better apparatus.

6. Where purchasing agents apparently do not know how to buy because they have no facts to check bids with and no methods of evaluating bids and therefore resort to haggling.

What the Seller Does

That's what they are saying about the purchasing agent—not all, of course—but many. But what is the matter with the manufacturer, you'll say, that he should admit to all this unsound and unfair treatment? Why does he fall for such methods? There is the rub. The manufacturer right now finds himself in a buyers' market. He is embarrassed in many fields by overcapacity and overproduction. He has permitted himself to become involved in a mad scramble for orders that has enmeshed him until for every story reflecting upon the purchasing agent there are fourteen about the manufacturer and his salesmen. As one man put it, "You can take a pure young man and make him a purchasing agent today and before Sunday the manufacturer's salesmen will have taught him all the dirty tricks in the business."

The utility purchasing agents say that the manufacturers are themselves the greatest culprits and are responsible for price buying. They say that first bids today are made for trading purposes only and that the bidders come to them before the ink is dry on the bids and offer to cut the prices. Therefore, they say, they too must use trading methods, because those are the methods that the manufacturers have developed and seem to understand. The purchasing agents say they are willing to pay fair prices, but that the manufacturers haven't the courage to put fair prices on their products and then stick to them.

To the Manufacturer

INDUSTRY needs more sincerity in selling. It needs manufacturers who consider that a bid is a word given—an honest offer of service to a friend—and not just a gesture in a sparring match. In other words, a bid from a responsible concern to a reputable customer should be a firm bid, the pledge of the house, signed with its good name. And such a bid is the equivalent of an open bid because there is no trick in it. It is not subject to revision, any more than the written word of that manufacturer is subject to question, because his honor is involved.

Firm bids preclude price cutting. They possess every advantage in competition. They maintain price levels by natural processes. They protect both the seller and the buyer by banishing the unseen menace of deceit.

The small manufacturer also charges that although the large electrical manufacturers state that they desire competition and see no virtue in monopoly, yet they chafe under the competition of the small manufacturer and cut prices to get business, relying on price cutting and not on better quality, better delivery or better salesmanship to maintain their position. It is alleged that the spread of prices established by these larger manufacturers is unreasonably wide and is not justified by the savings effected in making and selling the larger quantity to the large buyer.

Again, the large manufacturer says that his responsibility to keep his plant busy gives him a natural right to price low at times on orders needed to load some department of his factory that is running short. The small manufacturers, he says, with low overhead, have ample advantage in the market place, but rely too much on price paring and too little on engineering service and quality of product.

In this competition which is being waged between the manufacturers certain practices are followed which tend to aggravate the situation:

Tricks of the Manufacturer

1. The large manufacturer uses the lump sum bid as a lever to lower prices on individual products to compete with the small producer who specializes in that line. It is said that at times this is so manipulated that it has the effect of a straight price cut.

2. Allowances are made on old equipment taken back that range all the way from a reasonable scrap allowance to the full original price. This is pure price cutting when the allowance is more than the seller may reasonably expect to realize from the second-hand value.

3. Some manufacturers are making extravagant contributions in preliminary engineering expense for detailed working data that are out of all reason and constitute a price consideration because they put an undue extra burden on the profit.

4. Financial affiliations between some manufacturers and the utility companies are used to bring pressure from on high to throw the order.

5. Reciprocity arrangements are drawn into competitive bids to an extent that overshadows the actual comparative values involved and works an injustice upon bidders who are invited to compete with the assumption that it is to be a fair and open contest.

6. And then there are the everyday conditions of price cutting, where the manufacturer loses his nerve and pares his price for no other purpose than to get the order and camouflages it with all manner of alibis and explanations, such as a mistake in figuring, or new information, or an unexpectedly favorable purchase of materials, or some other cock and bull story. Here are a few of the usual experiences:

Case A—Purchaser in the market for a 000-hp., 000-r.p.m.,

synchronous motor. Low bidder $8,450, with other bids materially higher. One bidder received a tip that the other really higher bidder was $7,900. He revised his bid and took the order at that figure. The other bidder held his price and checked up afterward and they found out.

Case B—A purchaser advised a bidder that he was getting an extra 5 per cent from another bidder on some standard listed apparatus and that he would have to meet the figure. He did, and it developed that the extra 5 was on a single order aggregating over $50,000.

Case C—A recent order was taken for $58,650 on specific information from the buyer that a certain manufacturer had made a price of $57,000. The original bid of the successful (?) bidder was $74,000. A later check-up disclosed that original bids ranged from $70,077 to $74,000 and no other changes were made.

Case D—A bid was made when it was known that there were only two companies competing. One was high and under pressure came down, but the other bidder got the order, anyway. It was finally explained that the president of the purchasing company had over-ruled price and ordered the business to be given to the other firm on "policy," for reasons unknown to his subordinates.

The Moral Aspect

And there you are. Some men will say that all this is natural, because men are different and act differently. It has always been so, they say. But is that a reason? There are many time-honored practices that some day will give way to the onward march of principle and be changed. There are many things that men used to do that have been stopped and are not countenanced today. After all, it gets down to a very simple consideration of plain honesty. If a purchasing agent lies or otherwise deceives a bidder into cutting his price he is not dealing honestly. He is not fair. And if a manufacturer offers a bid that is not fair, either because the goods are not worth the money or because he has padded the price for trading purposes, he is not dealing honestly. It is not square when you come right down to the plain facts. It is trickery. It is an effort to take advantage of the other fellow.

Everybody will agree that it is considered wrong to slip your hand into a man's coat pocket and extract his wallet while his attention is distracted. No purchasing agent will do this to a salesman. No manufacturer will do it to a buyer. Well, the only difference is that dickering with bids and cutting prices has not yet lost its social standing. Today it involves no conspicuous degree of moral turpitude. But gradually it is going to be ostracized. The day will come when between intelligent business men price cutting will be taboo.

For with electrical men there is something more to it than just a matter of personal bartering between individuals. We have an industry involved, responsible for the maintenance of a great public service. We have a broad market to be maintained. And it is a matter of simple, inescapable truth that destructive commercial warfare between competitors or between buyers and sellers eventually demoralizes markets, wrecks the economic health of the industry and ultimately paralyzes the service upon which the public is dependent. And that is the reason why we find modern business bulwarked about with codes and standards and principles, with a highly developed system of self-imposed controls that have evolved out of experience because without co-operation and mutual good will there is no safety for investment, no stability upon which to base projects and plans.

And this responsibility for safeguarding the economics of business is an obligation that cannot be forgotten very long even in the relationships between one large buyer and his supplier. Profiteering purchasers and price-cutting sellers are forgetting this in an excess of zeal for sharp buying and for order snatching. But carried too far it brings its own defeat, for the manufacturer goes broke and the purchaser finds himself at last surrounded by enemies and he is lost.

Two Objectives

The greatest single problem in this whole situation to my mind is the difficulty of shaking men loose from the purely negative idea that because these unintelligent buying practices are general and have existed for long, they can't be changed. But that is just foolishness. Every buyer wants to get his money's worth. Every seller wants to get a fair price. No more is wanted, no less is satisfactory. What can be done, therefore, to put an end to the haggling and the price cutting? Fundamentally, it seems to me there are two things to be done:

1. *By the Purchaser* — Industry needs more intelligent buying. It needs purchasing agents who know the values of the equipment they buy and make of their function something more than an adroit matching of prices. It needs frank, open recognition of the fact that what is bought must be paid for and that bids which embrace elements of engineering and of service, as well as the delivered product, cannot be compared by a mere tallying of the total cost figures.

Therefore, the time must come—will come—when the purchasing agent no longer shall be rated for his penny-squeezing ability, but for his engineering skill in sensing and securing the greatest values for the money spent. And one of his greatest resources will be the good will and support of his suppliers.

2. *By the Manufacturer*—Industry needs more sincerity in selling. It needs manufacturers who consider that a bid is a word given—an honest offer of service to a friend—and not just a gesture in a sparring match. In other words, a bid from a responsible concern to a reputable customer should be a firm bid, the pledge of the house, signed with its good name. And such a bid is the equivalent of an open bid because there is no trick in it. It is not subject to revision, any more than the written word of that manufacturer is subject to question, because his honor is involved.

Firm bids preclude price cutting. They possess every advantage in competition. They maintain price levels by natural processes. They protect both the seller and the buyer by banishing the unseen menace of deceit.

All this will not happen at once—not this week. I know it. But industry can work toward it—can fight for it. And the logical approach to it is for the seller to refuse longer to cut his price because the buyer tells him to. Let him at least begin to protect himself by making sure that the other bids that he is asked to beat are comparable and that the purchasing agent is not lying. If he is asked to refigure after the bids are in let him at once demand that all the bids be opened to inspection. And also, it is time the manufacturer knew a little more about the reasons why he loses orders, through regularly organized post-mortem studies of the bids on his last business.

There is no lack of engineering in production. Production is organized strictly according to facts. But production is dependent upon purchasing for continuity and quality of supply. It is time to replace wit matching and blind bartering in industrial buying by an engineering approach to truth in values.

The days of haggling and bickering are all done in retail trade. Some day price cutting will pass out of industry. And men will wonder why it was that we could have been so long blind to economic truth.

Women Workers Used in Service Representative Plan

By W. G. Burrill
Commercial Manager Associated Gas & Electric System, Staten Island, N. Y.

THE home service representatives of the Associated Gas & Electric Company call on customers in their homes with the primary purpose of learning to what extent they are using electric service, checking the number and kinds of electric appliances which they own, learning what interest they have in other appliances and making minor repairs to appliances found on the premises which are out of use on account of cord or plug trouble. Women representatives are used for this home service work.

The result of this survey is posted on a card containing the customer's name and address and constitutes a record, which is brought up to date from time to time, of the customer's use of electric service in the home. When customers are found to be interested in appliances which they do not own the information is passed along to our sales organization by means of prospect cards and followed up by a salesman.

Home service representatives are not permitted to make sales. Their work is, in the last analysis, selling electric service, and is therefore more educational in character than anything else. Customers are contacted by the home service department through the mails with printed matter explaining the use and character of various appliances, together with recipes of foods to be cooked on the electric waffle iron, electric range, and frozen dainties to be prepared in the electric refrigerator. Contact is also made by means of lecture work to women's clubs, church societies, parent-teacher associations, etc. In addition to this type of activity classes are also conducted in co-operation with and in the public schools to children twelve years of age or thereabouts in the use of the electric washing machine and electric iron, how to read the meter, replace fuses, etc.

We feel that this work is doing a world of good, both to our customers and the company. Complaints of service are often adjusted by home service representatives, and when not possible of being adjusted are referred promptly to the proper department for attention, which gives us a check on the efficiency of various departments and enables changes in methods, routine and policies to be made before any great damage has been done to public relations.

In choosing home service representatives preference is given to high school graduates who have had the domestic science course or home-making course, supplemented by a background of housekeeping activities in their own homes. A course of training in company policies, rates and routine is given to the girls before they do any active field work, together with proper training in the care and operation of the various appliances. Our home service representatives are competent to demonstrate devices sold by salesmen, thus relieving the latter of this responsibility and enabling them to devote their time more intensively to sales promotion.

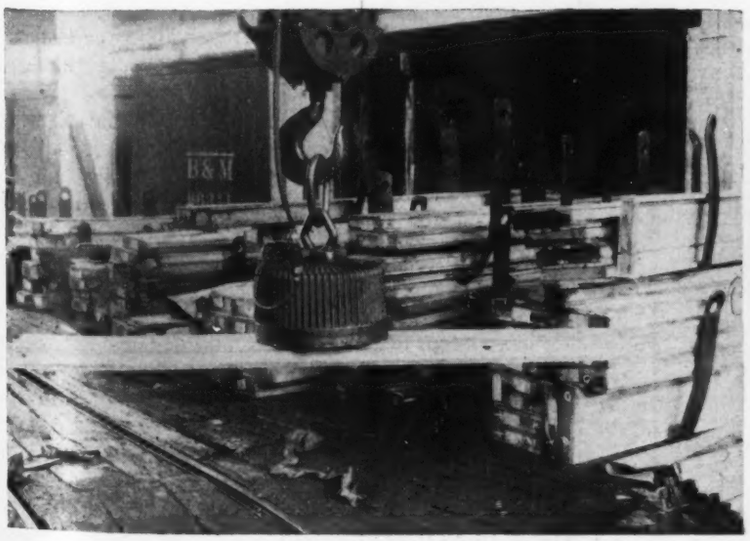
We feel that to get a coverage of our customers once a year one home service representative should be employed for each 1,000 residential customers, although we are not organized in our company at the present time on quite so extensive a scale.

Magnets Successfully Handle Coiled and Boxed Steel

COILED strip steel is a difficult material to handle, for unless the coils are tightly bound together they will pull apart and cause confusion to the handlers and damage to the steel. A strip steel coil, even though securely bound, is a heavy, awkward thing to handle and the moving of any amount of this steel requires a gang of husky men, who must be continually cautioned against battering the finished steel strip.

The Superior Steel Corporation at Carnegie, Pa., whose product is largely cold and hot rolled strip that is shipped both in coils and boxed flat, has adopted the Electric Controller & Manufacturing Company's lifting magnets for handling the finished steel, using manual labor only where necessary to move the bundles or boxes into closed freight cars. At this plant the company recently loaded 200,000 lb. of strip steel into box cars with the magnet and four men during a ten-hour shift. Before the magnet was purchased the most that six men could load was 140,000 lb. in a ten-hour shift.

The magnets usually handle two coils at a time, and if



Magnets handle 600 to 1,000-lb. packages of boxed strip steel. Thin sheets aid in handling of coiled strips

these two coils are not placed tightly up against each other one or both of the coils has a tendency to fall away from the magnet and be held in a vertical position. Because the steel must not be battered, it is not satisfactory for the coils to be dropped on their edge. In experimenting with the magnets on this job of handling coiled strip steel the Superior Steel Corporation discovered that a thin sheet of steel placed over the two coils to be lifted would spread the flux from the magnet sufficiently to hold both coils flat against the plate. It is a peculiar fact that this plate does not short circuit the flux, but causes the magnet to do a better job than without the plate.

Rural Bills Collected When Meter Is Read

THE practice of making collections by the meter reader at the time he reads the meter in rural sections has been found by the Portland (Ore.) Electric Power Company to effect economy and aid in maintaining closer relations with the farmer, according to R. R. Easter, manager of the Tualatin Valley division. Moreover, a complete understanding is had as to the bill without delay; collections are greatly facilitated, and in many cases where the farmer has no checking account he is aided in making his payment.

An intelligent meter reader can be of great value to the company in such cases, as he not only creates a proper impression of the company in the customer's mind but, also, he is able to learn of his needs in so far as additional current-consuming devices are concerned and, in many cases, to obtain his partnership in the business through the sale of stock. An ordinary bill form is used. The meter reader makes out the bill at the time the meter is read from the customer's schedule for the previous month, which he has with him. In a large percentage of cases the bill is collected at the time, conveniencing not only the farmer but the company as well.

It has been found, however, that such good results do not obtain in commuting districts, where customers are more in the habit of paying by check. Quite often they are away from home or do not have the available funds except for a short period after pay day; nor is the average commuter such a willing listener in so far as purchase of additional appliances or stock is concerned.

Service

The fundamental of good public relations is good service. There is no substitute for it. If we don't give good service, we won't deserve the public good will. So far as this company is concerned, it desires to have the good will of the public, but even more than this it desires to deserve it.

P. S. ARKWRIGHT,
President Georgia Power Company

Letters from Our Readers

An Insidious Misuse of the Schools

To the Editor of ELECTRICAL WORLD:

An insidious misuse of the public schools for the dissemination of government ownership propaganda is being made in New York City and probably elsewhere through the courses in "current events." For these courses weekly four-page leaflets are used, issued under the title "Loose-leaf Current Topics." These printed leaflets bear no editorial address, but those issued under the name of the "New York City Edition" are apparently published at 1123 Broadway, New York City, though there also appears to be a general publication office at 40 South Third Street, Columbus, Ohio.

The issue for the week of Feb. 27 to March 2, 1928, issued as Vol. XIII, No. 5, contains an article under the caption "Our State Water Power," beginning as follows:

> The cost of electricity to householders in New York City is 7 cents per kilowatt-hour, as charged by the New York Edison Company, a private company.
>
> This charge is "one of the cheapest rates in the United States for electricity generated from coal." In Toronto, Canada, the average cost of domestic service obtained from a public-owned water-power system was only 1.7 cents per kilowatt-hour in 1926.

Next, quoting Governor Smith, "New York State is probably the richest state in the Union in actual power resources. For years and years the resources have been allowed to run to waste." The article proceeds to ask why it is that, while other states and cities are enjoying the advantages of cheap electric power, New York State has been so slow in developing its vast sources of power in the St. Lawrence and Niagara Rivers, and answers by pointing out that "our Democratic Governor and our Republication Legislature cannot agree," and contrasts the opposing views on state development as against private development under lease.

Suggesting the precedent of the Port Authority, the article concludes that electricity generated under a similar authority would cost the consumer less than if developed by private capital, because there would be no stockholders and no profits.

The fair and impartial presentation of the elements of important economic problems affecting our national welfare has come to be recognized as a legitimate function of our public school system. We are living in an unprecedently complex civilization; we send our children to school to prepare them effectively to meet life's problems.

But an unfair and one-sided presentation of any great economic problem on which there is an honest difference of opinion is a misuse of the high privilege and duty of our educational system. The dissemination of untruths or half-truths through these leaflets, under official sanction and therefore accepted as free from any taint of propaganda, to thousands of teachers and tens of thousands of students, and through the latter again influencing tens of thousands of homes, is a thing to be vigorously combated.

GLADYS FELLOWS.
New York City.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Heat Transmission Through Boiler Tubes.—A discussion dealing with the rate of transmission of heat through a boiler tube from the outside inward; that is to say, a water tube boiler in contrast to the generally followed procedure of investigating the fire tube boiler has recently been completed. The information given is unusual in that the experimenter has endeavored to take into account all those variations from full-size boiler construction practice which are necessary in a small experimental installation. As a result of this investigation the following conclusions were developed: The coefficient of heat transmission of the apparatus is affected by the rate of gas flow and the temperature difference between flue gas and water as well as the pressure at which steam is generated and the temperature of the gas stream; the coefficient may be expressed in terms of the variables by means of certain derived equations; the water velocity in the tube has slight effect on the over-all coefficient of the transmission; the water velocity in the inclined tube of the apparatus varies as the steam rate and total energy input and tends to approach the practical maximum at slightly over 3 ft. per second; the water velocity is affected by the steam pressure, and the temperature gradient from the flue gas to the water in the tube varies with the flue gas temperature, the rate of gas flow and the steam pressure.—*Engineer (England)*, Feb. 10, 1928.

Generation, Control, Switching and Protection

Selective Protection.—H. PUPPIKOFER.—The steadily increasing unit size of generators and transformers in modern power stations ties up more and more capital per unit, causes a rising percentage of lost power when inoperative and warrants, therefore, expenditures for the best possible protection. The cost of the protective equipment may usually be considered to have been paid for when a large generator has once been saved from serious damage. Descriptions and operating characteristics are given of several modern selective protective systems, including the following: Back-flow watt relay, differential relay, self-balanced Ferranti relay, transformer relays, busbar protection, over-voltage protection, overcurrent protection, de-excitation methods and a note on internal fire protection. The necessity of an independent and absolutely dependable source of direct current which must be available at all times to provide the required control current for the protective relays in case of emergency is emphasized. A storage battery is frequently used for this purpose, although a Swiss concern advocates a small auxiliary generator on the shaft of the main machine to supply only the control current.—*Bulletin de l'Association Suisse des Electriciens*, February, 1928.

Generating Station Bus and Switch Structure Design.—Data as to the types of indoor bus and switch structures being used in 24 typical generating stations selected to give a great diversity of size and location from among those of more recent design in the United States are included in this report of the electrical apparatus committee of the N.E.L.A. Among the factors which have been considered in the course of the investigation and compilation of data are: Isolated phase versus adjacent phase; vertical isolation versus horizontal isolation; gasproof construction; fault bus protection; insulation of buses; bus housing construction, and cell construction. The comments of several manufacturers have been incorporated in this compilation as an expression of contemporary possibilities in this direction. Single-line wiring diagrams and simplified layouts of equipment placements have also been included.—*Serial Report National Electric Light Association*, February, 1928.

Units, Measurements and Instruments

Ground Detection.—JOHN AUCHINCLOSS.—The various means of detecting the impairment of resistance to ground has been considered, with particular reference to the instruments used for such determination. The various types of commercial circuits call for different schemes of ground detection and each is described in connection with the individual type of circuit for which it is adapted. In this connection the 125-volt, direct-current, two-wire ungrounded circuits, the Edison three-wire ungrounded neutral systems, the two-wire alternating-current circuit, the two-phase system, the three-phase, three-wire circuit and the specific considerations and wiring connections proved desirable by practical experience are offered.—*General Electric Review*, February, 1928.

Electricity Meter Accuracy.—G. L. E. METZ.—The ratio and phase-angle effects on the accuracy of watt-hour meters is developed in connection with the influences exerted by current transformers and a consideration of recent British specification standards. The author has considered the factors which influence the accuracy under operating conditions and under changes in phase angle. It is concluded that the errors cannot be reduced greatly in current transformers without increasing their size, while in the case of meters the difficulties in manufacturing procedures would be augmented if a higher degree of accuracy is required.—*Electrical Review (England)*, Feb. 17, 1928.

Transmission, Substations and Distribution

Steel-Cored Aluminum Conductors.—E. T. PAINTON.—A general consideration of the application of steel-cored aluminum conductors to transmission line use, with particular reference to the results obtained in installations in Scotland. The economical and technical advantages as reflected in increased span length and resistance to corrosion have been considered by the author. As the result of severe tests, the suitability of this type of construction has been established by practical use. The methods found most desirable for erection purposes have been outlined.—*Electrician (England)*, Jan. 27, 1928.

Mechanical and Electrical Properties of Conductors for 220-Kv. Lines.—Avoidance of corona losses dictates that conductors to be used on 220-kv. lines shall have an outside diameter of about 1 in. Several types of conductors have been made available by wire and cable manufacturers to meet special conditions imposed by the 220-kv. conductor problem, and it is the purpose of this report of the overhead systems committee of the N.E.L.A. to present the physical, mechanical and electrical characteristics of a group of selected sizes of each type so that the designing engineer may have reliable data on a comparative basis. This report includes a discussion of corona loss and of tests for its determination. Tabulated results and characteristic curves indicating the properties investigated have been included and statements by manufacturers and research results are appended.—*Serial Report National Electric Light Association*, February, 1928.

Motors and Control

Synchronous Motor Drive With Dynamic Braking.—C. E. CREASE.—A new type of installation in which dynamic braking has been utilized to secure quick and uniform emergency or safety stopping of the synchronous motor used in a rubber mill is described in the article. The results are accomplished by disconnecting the motor stator from the alternating-current supply and connecting it across a resistance of suitable value while the rotor field circuit, by short circuiting the motor field rheostat, is increased to its maximum value. Full magnetic

push-button control is utilized for this 300-hp. machine. — *Electrical News (Canada)*, Feb. 15, 1928.

Electrophysics, Electrochemistry and Batteries

Some Experimental Difficulties With the Electro-Magnetic Theory of Radiation.—ARTHUR H. COMPTON.—It has become increasingly evident during the past few years that the classical electromagnetic theory of radiation is incapable of accounting for certain large classes of phenomena, especially those concerned with the interaction between radiation and matter, according to the author. The more serious difficulties which present themselves in connection with the theory that radiation consists of electro-magnetic waves propagated through space in accord with the demands of Maxwell's equations have been classified as the oscillatory source of the waves; the photo-electric effect; the scattering of X-rays, and of the recoil electrons; and the individual interactions between quanta of radiation and electrons. The author has considered the problems in detail and does not negate the concept of waves of radiation. He concludes, however, that energy is not transmitted by such waves. The power of the wave concept in problems of interference, refraction, etc., is stated to be well known, but whether the waves serve to guide the photons or whether there is some other relation between photons and waves remains an open question.—*Journal of the Franklin Institute*, February, 1928.

The Adsorption of Gases by Solids.—H. H. LOWRY and P. S. OLMSTEAD.—While many attempts have been made to develop a theory of adsorption of gases by solids which will allow quantitative prediction of the effect of changes in temperature and pressure on the quantity of gas adsorbed by a given adsorbent, none of the theories, with the possible exception of that of Polyani, according to the authors, may be said to be satisfactory. This is due to the fact that the mathematical relationships resulting from the various theories have all contained constants which cannot be directly determined. As a result there now exist many empirical equations which fit with equal satisfaction the data obtained either at constant temperature or at constant pressure, or with constant amount adsorbed. Polyani's theory, on the other hand, assumes that the force of attraction of the solid adsorbent for the gas molecules decreases with increasing adsorption according to the characteristics of the material, but is independent of temperature and can be determined from a single isotherm. The present investigation has been undertaken in an endeavor to amplify and co-ordinate the information now available and the theories involved regarding the adsorption of gases by solids.—*Reprint B-279 Bell Telephone Laboratories, Inc.*

Telegraphy, Telephony, Radio and Signals

Grid Current Modulation.—EUGENE PETERSON and CLYDE R. KEITH.—The term grid current modulator as used by the authors refers to those vacuum tube circuits in which modulation is initially produced in the grid circuit of a three-electrode vacuum tube due to the non-linear grid current-grid voltage relation. Comparison with a representative plate current modulator using the same tubes and the same plate potential shows that by modulating at and using the plate circuit solely for maximum efficiency in the grid circuit amplification, the maximum power output is increased about eight times, the power efficiency is increased about five times and the ratio of side-band output to signal input is increased approximately three times. This improved performance has been made possible by a detailed study of the fundamental processes involved and by a design of the tubes and associated equipment, such as transformers and filters, to permit these fundamental processes to operate to their best advantage. The article concludes with an application of the principles involved to an experimental carrier-telephone system for which the operating features of tubes, filters and transformers are discussed.—*Bell System Technical Journal*, January, 1928.

Power Plants for Telephone Offices.—R. L. YOUNG.—A brief discussion of some of the more important problems connected with the supplying of power to telephone offices and developments which are being perfected to bring about economies. The author has included consideration of the factors of commercial types of charging generators and appropriate filters, power factor correction, complete power unit assemblies for small installations and the development of more nearly automatically controlled power installations with the object of reducing supervision. The subject of battery reserve is also considered and the tendency exhibited in the design and application of the equipment discussed is indicated with a view toward future developments.—*Reprint B-276 Bell Telephone Laboratories, Inc.*

A High Efficiency Receiver for a Horn-Type Loud-speaker of Large Power Capacity.—E. C. WENTE and A. L. THURAS.—A telephone receiver of the moving coil type which is particularly adaptable to the horn type loud-speaker and which is said to represent a notable advance over similar devices at present available is described by the authors. The design is such as to permit of a continuous electrical input of 30 watts, as contrasted with the largest capacity heretofore available of about 5 watts. In addition, measurements show that the receiver has a conversion efficiency from electrical to sound energy varying between 10 and 50 per cent in the frequency range of 60 to 7,500 cycles. This contrasts with an average efficiency of about 1 per cent for other loud-speakers, either of the horn or cone type. Combining the fifty-fold increase in efficiency with a fivefold or sixfold increase in power capacity, a single loud-speaker unit of the type here described is capable of 250 to 300 times the sound output of anything heretofore available.—*Journal of the Franklin Institute*, January, 1928.

Traction

Operating Costs of Industrial Trucks.—C. B. CROCKETT and H. J. PAYNE.—All direct costs of handling materials by industrial trucks are influenced by operating conditions. Theoretical curves are presented showing the effect on the operating costs of different types of trucks resulting from variations in length of haul, amount of material to be handled, condition of runways and number and severity of ramps. In addition there are other conditions having a decided effect upon the cost of operation but which defy analytical treatment. The author lists these as width of runways and available space, fragility of material handled, special requirements in handling, labor market conditions and range of uses for which equipment is employed. The curves presented are not offered as accurate results of tests made nor are they true graphical representations of the formulas upon which they are based. They are rather a suggested method of approach to the problem of selecting the most economical equipment operating under given conditions. — *Iron Age*, Feb. 9, 1928.

Miscellaneous

Electricity on the Farm.—The material presented in this bulletin represents a summary of available information by the Committee on the Relation of Electricity to Agriculture regarding the rural uses for electricity. It is stated to be offered not as the last word upon the subject but rather as an elementary treatise of a development which promises to grow with astounding rapidity. The energy requirements for cooking have been tabulated for farms in various localities, with certain minimum numbers of family members, and have been reduced to average values. Appliance factors as well as those concerned in the laundry, household refrigeration, farm refrigeration, water supply, radio application and miscellaneous uses are offered. Wiring installation costs and recommendations for adequate, safe and satisfactory service are included. The recent developments of insect destroyers of various kinds, the thermal requirements for incubating and breeding purposes, and the demonstrated usefulness of ultra-violet and incandescent lighting in poultry raising receive authoritative treatment in this comprehensive summary of rural applications. — *Bulletin Vol. 4, No. 1, Committee on the Relation of Electricity to Agriculture.*

News of the Industry

St. Francis Dam Goes Out

Failure of Los Angeles Municipal Structure in San Francisquito Canyon Causes Heavy Loss of Life and Property—Power House No. 2 Demolished

ANOTHER flood disaster affecting electric light and power service has been added inside a twelvemonth to those on the Mississippi and its tributaries and in the New England States. This time the scene shifted to a third geographical district, southern California, and the failure of man's handiwork rather than the uncontrolled operation of natural forces is the cause to which, in the absence of any evidence of earthquake or dynamiting, the torrent must be ascribed.

It is estimated that from 300 to 400 lives were lost and that damage to property reaching $15,000,000 was done when the St. Francis Dam on the aqueduct of the city of Los Angeles, which stood in San Francisquito Canyon, 40 miles north of the city, failed at 11:58 p.m. on March 12. Approximately 38,000 acre-feet of water was impounded by the dam, all of which escaped. The wall of water, which is said to have been fifteen feet high, swept aside every structure in the canyon and flooded Santa Clara Valley.

According to H. A. Van Norman, assistant chief engineer of the Los Angeles Water and Power Department, this is the explanation of the breaking of the dam: "Both sides of the dam gave out at the sides. The water saturated the ground deep into the hills at either side and this ground gave way first at the west side of the dam. When the ground gave way at the west side it weakened the concrete structure of the dam itself, and it sheared out completely on that side. Then the east side gave out in a similar manner. The remarkable thing is that the center arch on the dam, 75 ft. wide and 208 ft. high, is still standing."

The city had two plants in San Francisquito Canyon—No. 1, above the St. Francis Dam, with a capacity of 40,600 kw., and No. 2, immediately below it, with a capacity of 52,500 kw. Reports declare that the lower plant has been completely demolished and that all the operators and families to the total of 64 lost their lives. The Southern California Edison Company took over the load of the bureau when the city lines went out and is without difficulty meeting the demands for energy throughout the system.

It is estimated that the damage to the properties of the Bureau of Power and Light will be in excess of $5,000,000, and general property damage is estimated at $10,000,000 in addition.

A camp belonging to the Southern California Edison Company which had been established in the valley, in the path of the flood, was swept away, and it is believed that 40 or more of the 170 transmission-line workers housed there lost their lives. The roar of the breaking dam and flashes from broken power lines were the first signals of danger to the inhabitants of the valley, most of whom were asleep. By daylight the torrent had reached the Santa Clara, more than 20 miles from the dam. The river, normally a dry bed, was running fifty feet deep and two miles wide, sweeping away everything in its path. In another hour or two the stream had dissipated its force at Ventura and left a comparatively quiet flow of about six feet. Then this too trickled away, leaving only deep pools.

From Saugus on the east to near Oxnard on the west, a stretch of 40 miles, every power and telegraph wire was down, all bridges were out, highways were buried under many feet of mud or torn away by the force of the flood, and twisted snarls of railroad track lay far from the right-of-way, the sleepers still clinging at odd angles to the rails.

R. H. Ballard, vice-president and general manager Southern California Edison Company, sent the following telegram to the ELECTRICAL WORLD on Wednesday:

"We are operating normally and in addition easily carrying the full load of the municipal power system, which is completely shut down. Our only loss was a few towers standing in the path of the flood and a small switching station, and we were able to pick up the

St. Francis dam and reservoir before the break—Finished May, 1926

Los Angeles load of the municipal system within a few minutes after its stations shut down and to establish new connections for Santa Barbara and Ventura Counties within a few hours. One of our transmission-line construction camps was located about twenty miles below the municipal dam and in the path of the flood. We have suffered some loss of life to employees—so far about eight known casualties with a number still missing."

A later dispatch says that on Tuesday night the Edison plants carried a peak of 628,000 hp., the highest in the history of the company. On the corresponding day of last week the peak was 532,000 hp., and the highest previous peak on record was 598,000 hp. Except for local disturbances in the flooded area, there has been no interruption to the service of the Southern California Edison Company. The monetary loss to that company will be less than $100,000, represented by damage to eight high-tension-line towers, a group of small cottages and a bank of oil switches which were in the path of the flood. The Long Beach steam plant was an important factor in meeting the emergency.

Description of the Dam

Dimensions and other details of construction of the St. Francis Dam are listed in a report by W. W. Hurlbut, office engineer of the Bureau of Water Works and Supply, Los Angeles, dated July 1, 1926. It describes the dam as follows:

"The St. Francis Dam was completed May 4 and contains 167,000 cu.yd. of concrete, of which 94,000 cu.yd. was placed during this fiscal year. The maximum height of the dam is 208 ft. The maximum width is 169 ft. and the length is 668 ft. with an additional length of dike of 613 ft. The design of the dam is the gravity type arched for additional safety."

State and local officials are at a loss to find a reason for the sudden collapse, and searching investigations are to be launched at once. Edward Hyatt Jr., State Engineer, said:

"According to our reports, the dam was in perfect condition and had been inspected regularly under state supervision. It does not seem likely that it could have been dynamited, as a tremendous quantity of explosives would have been necessary. We expect to go to the bottom of the affair."

Dam in Kickapoo Fails

An ice jam in the Kickapoo River carried out a 60-ft. dam at La Farge, Wis., on Tuesday, interrupting the service of the local isolated electric plant, which supplies 800 inhabitants. This is the second serious interruption in recent years. Service will probably be resumed by arrangement with a nearby transmission system. As a result of the accident highways became impassable in all directions, a passenger train was marooned in the village and farms were flooded.

Norris Bill Gets Through Senate

By 48 to 25 It Is Passed Without the Harrison Amendment—House Expected to Disagree—First Session of Power Investigation—House Committee Is for Boulder Dam

By Paul Wooton
Washington Correspondent of Electrical World

BY A VOTE of 48 to 25 the Senate on Tuesday, March 13, after a debate lasting three weeks, adopted the Norris joint resolution providing for federal operation of the government's plants at Muscle Shoals. Under the resolution, the money derived from the sale of hydro-electric power will be used for experimentation in the manufacture of fertilizers.

Amendment after amendment was rejected by the Senate, the most important being the "Underwood" plan submitted by Senator Harrison of Mississippi, proposing a 50-year lease to private interests with the stipulation that 40,000 tons of fertilizer must be produced annually. This was defeated by a vote of 48 to 26.

Senator Sackett of Kentucky presented a plan to lease the plant to private interests. He said his amendment was identical with the Norris scheme except in the main issue of private versus government operation. This amendment was lost on a *viva voce* vote.

On the final vote twenty Republicans, twenty-seven Democrats and the lone Farmer-Labor member voted for the resolution, fifteen Republicans and ten Democrats casting their ballots against government operation. The resolution now goes to the House military committee, which will probably hold hearings upon it. The consensus of opinion is that no agreement between the two houses will be reached at this session of Congress.

Advocates of government ownership are acclaiming the Senate's passage of the Norris Muscle Shoals resolution as a great victory for the principles for which they stand. If the House can be influenced to follow the example of the Senate, they see the beginning of the Tennessee Hydro-Electric Commission, modeled along the lines of the Ontario Hydro-Electric Power Commission. At the beginning of the debate Senator Norris frankly announced that one of the purposes of his resolution was to demonstrate the advantages of government operation of power plants. Not only does the government by the terms of this resolution enter into the business of generating and selling power, with preferences to municipalities and farmers' organizations, but the resolution sets up the Federal Power Commission as the agency to regulate the rates to be paid for this power within the states. That particular part of the resolution, Senator Tydings of Maryland told the Senate, is unconstitutional.

It also is recognized that the passage of the Norris resolution greatly strengthens the hands of the supporters of the Swing-Johnson Boulder Canyon bill. The Senate's indorsement of government operation at Muscle Shoals is regarded as paving the way for a similar effort on the St. Lawrence and on other streams where large power resources are available. The hope of those who are opposed to government in business is that the House, which has become the conservative branch of Congress, may insist upon the elimination of the government operation feature of the resolution. The requirement to operate plant No. 2 also will be opposed strenuously in the House. Some are of the opinion that the effort on the part of the government to operate that type of plant, which many regard as obsolete, is foredoomed to failure and is likely to result in a reaction against any use of Muscle Shoals for fertilizer production.

The fact that only twenty-five Senators voted against the resolution came as a surprise, but is accounted for by the consideration that such a vote would be interpreted as an attempt to prevent the use of Muscle Shoals for fertilizer purposes. In addition, so much has been said about cheap electric rates in Ontario and at publicly operated plants that the impression was created that existing domestic rates are too high. Some of the Senators who had voted against the Walsh resolution are thought to have seized this opportunity to demonstrate that they are not always on the same side as the power companies.

Committee Indorses Boulder Dam

A report recommending the passage of the Swing-Johnson Boulder Canyon bill was submmitted to the House of Representatives on March 15 by its committee on irrigation and reclamation. It was concurred in by all members of the committee except Representatives Douglas of Arizona, Winter of Wyoming and Leatherwood of Utah. They expect to submit minority reports, and Mr. Douglas has already seized on the St. Francis Dam disaster to ask, through a press release, whether the far greater dam in Boulder Canyon might not prove a menace instead of a protection to the Imperial Valley. Representative Davenport of New York submitted additional views, disagreeing in part with the majority. The conclusions of the majority of the members of the committee follow:

This bill should be passed because

First—Congress should no longer risk a flood catastrophe to Imperial Valley—a catastrophe which further delay only courts.

Second—Reclamation possibilities in the lower basin should be safeguarded and taken care of before it is too late. Unless something is done, the river will be acquired for power development exclusively. Mexico is constantly building up added claims to its waters.

Third—The Mexican situation must be met. It is not sound policy to allow a condition to continue by which that country

may and will go on using more and more water from the river, and this at the expense of existing and future irrigation in the United States.

Fourth—The government should aid its people to secure their necessities in the way of domestic water supply, where it can do so, as here, without cost and as an incident in carrying out other federal purposes such as river regulation and reclamation.

Fifth—It will convert a natural menace into a national asset.

Sixth—A financial scheme is presented by which the development will be completely prefinanced, thus fully protecting the federal treasury and the general taxpayer.

Seventh—It settles in large part water rights between states in a sensible and practical way, substituting interstate agreements for interminable litigation and controversy. Further delay points to the latter untoward results and the disintegration of the plan of settling water rights by interstate compact.

N.E.L.A. Men Are Witnesses

A large amount of testimony in the form of documents was introduced at the first public hearing of the Federal Trade Commission's investigation of public utilities on Thursday, March 8. Commissioner Edgar A. McCulloch presided. Representatives of the National Electric Light Association and the American Gas Association were examined. Further public hearings will, the commission informs the Senate in its first report, made on March 15, be held as fast as adequate preparation for them can be made.

To meet the situation presented on the Colorado, St. Lawrence, Columbia and Tennessee Rivers, where development plans may originate with the government, a set of principles which should govern the relationship between the government and the utilities has been proposed by J. T. Newcomb, counsel for the Joint Committee of National Utility Associations. In an address made on March 5 before members of the Cosmos Club in Washington, Mr. Newcomb said, in part:

1. No such projects should be undertaken unless they are clearly and primarily entered upon in the fulfillment of federal government purposes. This, it seems to me, must be a fundamental requirement, although it is true that in performing such functions the government will frequently find itself necessarily involved in incidental activities of a different character.

2. The right to use the water should be disposed of by the government at its fair value. It should not be sold for less than its value, because neither power users nor anybody else should be made the special beneficiaries of government expenditures by getting water or power at less than its value. On the other hand, the power users should not, through coercion or otherwise, be compelled to pay more than the fair value for the right to use the water, because to do so would make them a class specially taxed for the construction of a public improvement.

3. In addition, it seems to me that the legislation should specifically promote by definite and certain terms co-operation with the existing power producers, whose plans reach far into the future. This requires, of course, a clearly announced policy on the part of the government, firmly adhered to, which can be depended upon by the private companies.

Savings-Bank Investment Bill Prospects Good

Both Houses Pass It, and It Awaits Governor's Action — Governor's Water-Power Measure Gets Its Quietus in Upper House

THE bill introduced by the committee on banks authorizing the investment by savings banks in the bonds of certain electric, gas and telephone corporations passed the New York Assembly on Thursday without debate by a vote of 130 with no opposition. This bill previously passed the Senate. It now goes to the Governor for executive approval. The Assembly also passed and sent to the Governor the bill authorizing savings banks to invest in bonds and obligations of railroad corporations. The expected opposition to the savings-bank investment bills failed to develop in the Lower House, the Republicans having approved of their passage in caucus.

In the Senate opposition was led by Minority Leader Downing. There the bill relating to utility bonds was passed by 33 to 15. All of the opposition came from Democratic Senators from New York City.

Following the example of the Assembly, the Senate by a party vote defeated the Governor's bill to set up a Water Power Authority, the Republicans offering to send to him again their bill of last year creating another committee to study development proposals. The Sargent water-power bills, protecting the interests of the state in the river regulating districts, tentatively approved by the Governor, are understood to be slated for passage.

Governor Smith has approved two minor water-power bills passed by the Legislature. One is designed to prohibit any water-power development projects in the Adirondacks where the altitude is more than 1,500 ft. This is to protect Saranac Lake, Lake Placid and other mountain resorts. The other measure would have a commission of three named to determine a fair return to the state for land flooded in connection with water-power projects along the inland streams.

Radio Adjustment Now Awaits Conference

On motion of Senator Dill of Washington the Senate on Tuesday demanded a conference upon the "equal distribution" amendment that was attached by the House to the Senate bill extending the life of the Federal Radio Commission for one year. Although sympathetic with the purpose of the House to distribute radio stations equally upon the basis of population, Senator Dill said that the language of the amendment made it unworkable and impracticable. The conference was set for Friday, March 16. Senator Dill said that although the commission's regulatory powers would technically expire at midnight of March 15, he believed the commissioners would continue to serve until the conference reached an agreement. Nominally Secretary Hoover will again be in charge.

Philadelphia Electric Will Speed 1928 Program

The Philadelphia Electric Company, through its president, William H. Taylor, has just announced some of the details of its twelve-million-dollar building, construction and equipment plans for 1928, following a statement by Arthur W. Thompson, president of the United Gas Improvement Company, that a construction program of $20,000,000 will be pushed by the U.G.I. and its allied companies in an effort to relieve non-employment. Mr. Taylor said:

"Our program involves such major items as the installation of huge condensers and transformers in the Plymouth Meeting substation near Norristown and the Westmoreland substation in Philadelphia, erection of an 80,000-kva. tie line between Plymouth Meeting and the generating station at Norristown of the Philadelphia-Suburban Counties Gas & Electric Company, the new Lamokin substation which will be built in Chester to supply power for the electrification of the Pennsylvania Railroad between Philadelphia and Wilmington and other important additions. The Lamokin substation will contain three 21,000-kva., single-phase, 25-cycle motor-generator sets—the largest of their kind which have been built."

Nine Hundred at Tulsa

Oklahoma Utilities Association Hears Industry Leaders in Its General and Group Sessions—Growth of Electric Generating Stations in State

FORMER attendance records were shattered at the tenth annual convention of the Oklahoma Utilities Association, held at the Mayo Hotel, Tulsa, on March 13, 14 and 15. Approximately nine hundred had registered at the end of the second day. General sessions were held in the forenoons, and the various groups—electric light and power, gas, electric railway, telephone, public relations, manufacturers and suppliers, public relations and women's committee—held afternoon sessions.

E. F. McKay, manager of the association, in his annual report, revealing substantial association growth, said that the total capacity of electric generating stations in the state is now 360,000 hp. At the Wednesday morning session J. F. Owens, Oklahoma City, chairman Public Relations National Section, N.E.L.A., especially stressed the work of the committee on co-operation with educational institutions. About six hundred persons attended the banquet, where the principal speaker was Representative Charles A. Eaton of New Jersey. The election of officers was scheduled for Thursday afternoon.

Purchases and Mergers

Buffalo, Niagara & Eastern Subsidiaries to Be Merged—Transfers of Control of Minor Private and Public Plants in Many States Reported

MERGER into the Buffalo, Niagara & Eastern Power Corporation of its subsidiaries, to take place in the near future, following a stock issue, was announced at Buffalo on March 13. The merger is to embrace the Buffalo General Electric Company, Niagara Electric Service Corporation, Niagara, Lockport & Ontario Power Company, Niagara Falls Power Company and the Tonawanda Power Company.

Citizens of Kinston, N. C., will determine the fate of Kinston's municipal electric light plant at a special election July 3. The Carolina Gas & Electric Company, with headquarters at Kinston, as already reported, offers to pay $1,271,000 for the power house, besides making the city a present of a "white way," and the Aldermen accepted this bid subject to ratification. Livingston & Gregory, of New York and Salisbury, N. C., have resubmitted their offer for the property—$1,357,000, including a good-faith check for $100,000 deposited with the bid.

The Appalachian Electric Power Company has bought the Montvale-Thaxton Transmission Company's line between the Virginia towns indicated, previously served by the Bedford City municipal plant.

The South Georgia Power Company has taken over and grouped under one management the municipal plants at Richland, Buena Vista and Lumpkin, Ga., all of these towns now being on a 110-volt transmission line reaching Americus and Columbus.

John F. Brewer of Mountain View, Ark., has sold a 99-year franchise for supplying power and light in that place to the Arkansas Power & Light Company.

The Bristol (Tenn.) Gas & Electric Company has purchased the franchise of the Boon Creek Electric Company at Mountain City, Tenn.

Mendenhall (Miss.) taxpayers have approved the sale of the municipal electric system to M. L. Culley for $10,000 cash.

Upon rehearing of petitions, the Illinois Commerce Commission has authorized the Illinois Power & Light Corporation to purchase the Arenzville Light & Power Company for $74,000 and the Prather & Hill Electric Light and the Elkhart Electric Light companies for $40,000. Petition for permission to purchase the municipal electric system in Dahlgren, Ill., has been filed with the commission by the Central Public Service Company.

The Interstate Power & Light Corporation is reported to have acquired the lighting plants in Mansfield, Seymour, Ava, Norwood and Mountain Grove, Mo., which will be operated as the Missouri Electric Power Company.

The Maryville Electric Light & Power Company has applied to the Missouri Public Service Commission for authority to buy the distribution plant of the Union Star (Mo.) Electric Company for $12,500. The commission has authorized the Fairfax Light, Heat & Power Company to sell its electrical distribution plant to the Tarkio Electric & Water Company for $25,000.

The Central Power Company has purchased the distribution systems in the town of Brock, as previously noted, and also in Dunbar and Farwell, Neb. The lines were formerly owned by these municipalities. All of the towns have been served wholesale by the Central Power Company.

Purchase of the municipal electric and water systems at Thomas, Okla., by the Southwestern Light & Power Company was authorized by the voters Feb. 14.

These purchases are reported from North Central states: The Otter Tail Power Company has bought the Makoti (N. D.) village lighting systems and plants at Binford, Eckelson, Dwight and Parshall, N. D.; Eastern Minnesota Power Company, the Pappenfus power system at Oak Park, Minn.; Dakota Power Company, the Custer (S. D.) Light & Power Company; Northern States Power Company, the lighting system at Ruthton, Minn.; Interstate Power Company, the Clearbrook (Minn.) plant, and Montana-Dakota Power Company, the plants at Larson, Beach, Sentinel and Butte, N. D.

The Southern Colorado Power Company, through W. N. Clark and George W. Milliken, has offered the city of Lamar, Colo., $350,000 cash for its power plant if the city will grant it a 25-year franchise.

The South American Power Company, a subsidiary of American & Foreign Power Company, has taken control of the South Brazilian Railways Company from the International Light & Power Company. The South Brazilian Railways Company owns and operates the electric power and light and street-railway systems in Curityba, in south Brazil.

St. Louis Institute Meeting Well Staged

Large Attendance and Lively Interest Mark Regional Convention—System and Machine Stability, Automatic Switching, Lightning and Television Among Topics

A CRITICAL discussion that followed the presentations of two related papers—one on the influence of excitation systems on short circuits and maximum power and the other on a new development in voltage regulators—marked the high point in the regional meeting of the American Institute of Electrical Engineers held at St. Louis on March 7, 8 and 9. This convention of the Southwestern District of the Institute was successful in all ways, having to its credit an attendance of more than 400, a program of practical and interesting papers and a smoothness of organization and procedure that reflected great credit on the local St. Louis committees. A branch conference attended by students from many of the Southwestern colleges opened the three-day meeting. This was followed by a joint luncheon with the St. Louis Electrical Board of Trade, at which Bancroft Gherardi, president of the parent body, spoke on transatlantic telephony.

The first technical session was presided over by A. E. Bettis, vice-president of the Southwestern District. The development of an empirical method for determining leakage and fringing fluxes in an electromagnetic system was reported by W. L. Upson and E. L. Furth. Hans Weichsel did much to destroy the illusion that splitting the resistance rings on a squirrel-cage rotor will always result in an increase of motor starting torque. On the contrary, it will, according to the tests made by Mr. Weichsel, so increase leakage as actually to decrease that torque. The development of the various types of drives for tandem rolling mills was covered by A. F. Kenyon. Methods of calculation of power requirements were set forth.

The very worth-while results that have been obtained from consistent checking and testing of purchased material by the Kansas City Power & Light Company were enumerated at the second technical session by D. D. Clark and G. E. Meredith, whose paper was entitled "The Public Utility Laboratory and Its Relation to Service." Following this came a description, by Stanley Stokes and Leslie V. Nelson, of the metering equipment that is used to establish billing demands on the output of Cahokia station, where six sub-totalizers integrate the demands on six lines. The coincident registrations of these six are combined on the master totalizer.

Excitement Over Excitation

Insistence by Chairman L. F. Woolston kept impatient discussers in check after R. H. Park had read R. E. Doherty's paper on excitation systems until additional material for argument had accrued from the paper on voltage regulators by R. M. Carothers and C. A. Nickle. The theme of the first of the two papers was that in the performance of alternators both static stability—that is, stability under or more or less gradual accretions of load—and transient stability—stability under violent disturbance—might be greatly improved through rapid and generous response by the excitation system to the demand for large increase of field current by the alternator. Since the need for much faster excitation systems does exist, there has been developed to fill it a modification of the long-established vibrating-contact type of field regulator. This was the subject of the second paper. The differentiation of the new regulator from preceding practice is caused by the inclusion in it of means to hold the normally vibrating contacts in the closed position while the exciter current climbs in one step to, or as near to as is possible, that higher average value demanded for stability of the alternator under its new condition of load. Since 1920, when the general subject of excitation and machine stability was reviewed at the White Sulphur Springs convention, any paper bearing on this or related matters can be confidently counted upon to stir up a keen discussion, and, as just implied, the meeting under notice proved no exception. After Messrs. Park, Carothers, Nickle, Powell, Evans, Wagner, Ashbaugh and others had shivered their lances on one another's shields, Prof. Comfort A. Adams pointed out that the logical result of in-

vestigations into machine stability is the exact determination of the "dizzy edge" of instability and, following that determination, the approach of normal operation nearer and nearer to the edge in the desire to reduce ratio of output to weight of metal in machine design.

Since the introduction of the impedance relay in 1923 certain developments have come about in its design and in its application. These were reviewed in a paper by H. A. McLaughlin and E. O. Erickson. The methods of obtaining proper potential for the restraining elements without the use of high-tension potential transformers and the use of potential from condenser-type bushings were described. To make possible the use of low-tension potential, means for compensating for the voltage drop through power transformers and for the shifting of the secondary neutral point have been developed. These were described, as were also some special applications. Deprecation of the tendency to overenthusiasm regarding the capabilities of new devices was apparent in the discussion of this paper by H. P. Sleeper, W. H. Millan and O. C. Traver. All three agreed that in the purposes for which it was intended the inductive relay performed admirably, but that these purposes did not include all power-system relay applications. A preference for the classic method of balanced protection of parallel lines was voiced, this including the inductive relay as back-up protection after the failure of one of the parallel lines.

Automatic Switching

Some of the more common forms of automatic switching of incoming lines and transformers supplying power to alternating-current substations were described in a paper by A. E. Anderson. By making a few minor modifications in the schemes described it has been possible to control automatically a complete loop or ring system. The uses and the switching requirements of balanced or parallel incoming lines and of preferred-emergency equipments were discussed in some detail. The paper concluded with a brief discussion of automatic synchronizing and transformer switching.

J. B. MacNeill presented an interesting description of the design and performance of an improved type of moderate-capacity oil circuit breaker. Relatively high-power breakers having all three poles in a single round tank have been designed, and these, in addition to increase of rating for a given space, have shown improvements in performance over types previously available.

A simple method for reducing conductor vibration on transmission lines was presented in a paper on that general subject by Theodore Varney. In a previous Institute paper Mr. Varney had discussed the action of the wind on a suspended conductor and given rules for determining the wave length and frequency of the resulting vibration. Since the date of that presentation records have been kept of the wind action upon a large number of transmission lines equipped with different kinds of conductors and installed under various conditions. Data selected from these records were presented in the paper, which also included test results from experiments indicated by the character of the recorded information. In the analysis or solution of alternating-current problems it is frequently necessary to convert vector quantities from the exponential or polar forms into complex numbers or vice versa. The paper on vector calculating devices by M. T. Weinbach described some of them and gave examples of their use.

The planning of telephone exchange plans was covered in a paper by W. B. Stephenson, and tuned radio-frequency amplifiers were treated clearly and as simply as the subject would permit by R. F. Glasgow.

Ives, Peck and Cullen Contribute

The last item on the program of the technical sessions was a lecture by Dr. H. E. Ives on television. This lecture was open to the public and drew a large attendance. On the evening of the second day a popular talk on lightning, which was illustrated with lantern slides and motion pictures, was presented by F. W. Peek, Jr. This was reported last week on page 523. At the convention dinner-dance Charles E. Cullen, professor of law and business administration of Washington University, talked on "Sanity and Sane People."

Business Men Inspect New East River Station

The New York Edison Company's East River station, which has now installed one-tenth of its ultimate capacity of almost 1,250,000 kw., was thrown open on March 9 to inspection by a party of representatives of civic and commercial associations, under the auspices of the Fourteenth Street Association. Vice-President Arthur Williams told the visitors of the coming addition of a 160,000-kw. machine now under manufacture by the General Electric Company, and explained some of the devices used, such as the water-filled steel tubes for furnace walls and the coal- and ash-handling towers on the river's edge.

"This new station, as planned," Mr. Williams said, "presents the greatest program for power generation that has yet been conceived. And this is only one of the several giant power plants now engaged in giving New York electric service. The plans for its construction will proceed for at least the next decade, as the station is designed to help serve increases in the utilization of electricity until 1940." The cost of the completed structure is expected to exceed $100,000,000, he said. When it finally operates at full capacity it will require for steam condensing purposes a total of 2,160,000,000 gal. of water every 24 hours. This is more than twice as much as Greater New York consumes daily. The completed station will be capable of filling the light and power needs, as of the present date, of any state in the United States with the exception of New York, Pennsylvania, California, Illinois, Ohio and Michigan, Mr. Williams observed, on the authority of United States Geological Survey statistics.

To Promote Power Sales

Commercial Section, N.E.L.A., Meeting in Chicago, Turns Thought to Competitive Power Situation—Refrigeration and Merchandising Also Features

COMMERCIAL Section men of the National Electric Light Association held a two-day meeting last week at the Edgewater Beach Hotel, Chicago. Interest centered chiefly in the work of the merchandising, power and refrigeration committees. The first day was devoted to the committees on power, industrial heating, commercial cooking, refrigeration, domestic ranges and customer relations. The executive committee was in session the second day. No more meetings are to be held before the Atlantic City convention.

The power committee, under H. W. Derry, is engaged in an analysis of the trend of industrial power for the purpose of developing a graphic comparison of the use of steam, internal-combustion engines, private electric plants and purchased power. The manufacturers of steam and oil equipment, as Mr. Derry pointed out, are fighting for existence and perfecting improvements in efficiency that are making serious competition for electric power. Central stations must study the national trends and compare them with statistics on local conditions in order intelligently to direct power sales. Power load can no longer be taken for granted, he said. There is great need for trained man power in this field. S. L. Nicholson also pointed out the need for well-classified information on load characteristics, since conditions affecting load factor in many industries have greatly changed in recent years.

C. E. Greenwood, for the merchandising committee, reported very gratifying registrations in the "residence kilowatt-hour contest," entries for which close on April 1. Indications are that at least two hundred power companies will participate. This committee is about to announce an expanded program for concurrent appliance advertising by central stations, dealers and manufacturers for the season of 1928-1929. To the work of the intertrade conference, which has developed a statement of merchandising principles for the guidance of trade relations in electrical merchandising, a vote of appreciation was given. This agreement, which has been signed by officials of the various trades, will be submitted to the N.E.L.A. executive committee the latter part of this month for approval, before publication.

Chairman G. B. Richardson announced the plan for a twelve months' campaign of personalized direct-by-mail advertising, with neutral illustrations, which the refrigeration committee has prepared for use by local companies. Under this plan special mailing lists are

to be sent to Dallas, where the folders and letters will be printed by a special process, each piece bearing conspicuously the name of the recipient. The range committee is at work on a similar advertising campaign.

W. H. Sammis announced the completion of the industrial heating committee's motion picture of industrial heat applications, which is to be sold or rented to member companies. The electrical advertising committee reported by wire the successful progress of its salesman's school, then in session at the Edison Lighting Institute in Harrison, N. J., with 163 salesmen in attendance.

The trend of wiring requirements was discussed by E. W. Lloyd and S. L. Nicholson, who both called upon the power industry to take a constructive rather than a defensive interest in the development of the National Electrical Code. W. H. Hodge reported on a movement being organized by about thirty trades and industries to stimulate the modernization of homes. A committee from the N.E.L.A. Commercial Section will be appointed to co-operate.

New York Commission for Law on Sub-Meters

The annual report of the Public Service Department of New York, State Division, for the year ended June 30, 1927, filed with the Governor recently, says that in 867 of the 921 towns of the state electric franchises are in force or their exercise has been permitted by the commission. The report says that "progressive consolidation which has been taking place for the past decade has now reached the stage where the state is served by eleven principal groups. Interconnection between groups has progressed simultaneously to the point where it is possible now for energy to flow in almost every direction within the state."

After commenting on the rapid extension of rural electric service the commission makes reference to the practice of sub-metering, by which a landlord buys energy at wholesale and makes a profit by retailing it, sometimes at rates in excess of those approved by the commission, to his tenants. Concerning this practice, which has aroused great complaint—especially in Manhattan Borough, New York City—the commission says:

> The commission has referred in its annual report to the so called sub-meter, over which it has no jurisdiction. Complaints respecting sub-meters do not decrease. While there is a disposition on the part of some engaged in rendering service through sub-meters to improve conditions and to emulate service corporations in maintaining the meters in good condition, their number is relatively small. Not until such meters are placed under proper supervision will the public be fully and adequately protected.

A recent newspaper article put the number of sub-meters in Manhattan at 115,000, an increase of 40 per cent in five years.

Briefer News

HIGH-VOLTAGE TRANSMISSION EXTENSION IN NORTH CAROLINA.—The Carolina Power & Light Company is expected soon to begin construction on 138 miles of 110,000-volt transmission lines from Sanford to the Cape Fear station, from Norwood to connect with existing lines, from Canton to Greenville, from Canton to Asheville and from Moncure to Sanford.

HEARING THIS MONTH ON ROYAL GORGE PROJECT.—The Colorado Public Utilities Commission has set March 29 at Pueblo to hear the petition of the Public Service Company of Colorado for permission to erect a hydro-electric plant in the Royal Gorge. Although the company says it will not mar the beauty of the gorge, there are several hundred petitions asking that the grant be denied.

ENGLISH RIVER SITE APPLIED FOR.—Application has been made by George Farlinger of Sioux Lookout, Ontario, to the Lands and Forests Department for a lease of the power rights at Ear and Manitou Falls, on the English River, at the western outlet of Lac Seul, near the Manitoba border. The site for which Mr. Farlinger seeks a lease is estimated to be capable of developing about 60,000 hp.

CHESAPEAKE & OHIO RAILWAY CONTRACTS FOR 9,000,000 KW.-HR. WITH VIRGINIA PUBLIC SERVICE.—A contract recently negotiated between the Virginia Public Service Company and the Chesapeake & Ohio Railway Company for electric service at all points along that road in the utility company's territory includes 126 items and involves approximately 9,000,000 kw.-hr., bringing an annual revenue estimated at $225,000.

CENTRAL HUDSON GAS & ELECTRIC GIVES $10,000 TO ENGINEERING FOUNDATION.—A contribution of $10,000 to the Engineering Foundation endowment fund has just been made by the Central Hudson Gas & Electric Corporation of Poughkeepsie, N. Y. In making this donation T. R. Beal, president of the company, says: "This amount was in fact earned by our employees by their more efficient operation of the physical properties under their care. It represents $10,000 of return premiums paid during the past year on accident insurance as the result of the company's excellent record in preceding years."

POWER CANAL PROVES DEATH TRAP FOR DEER.—A concrete-lined power canal belonging to the California-Oregon Power Company and located in the mountainous regions of southern Oregon is proving a death trap for deer, according to the game authorities. Nine-foot sloping walls render it impossible for the animals to get out of the canal when once they try to cross it, with the result that the brutes flounder about until they become exhausted and drown. The power company will probably construct bridges over the canal at intervals so that the deer may cross in safety.

NATURAL GAS MAY BE FUEL FOR CANADIAN PRAIRIE PLANTS.—The Calgary Power Company, which controls hydro-electric development on the Bow River in the Province of Alberta and has been spreading its lines over the southern part of the province, has taken an option on approximately 10,000,000 cu.ft. of natural gas in the Turner Valley field. Whether the gas is for steam-electric generation of power the company refused to say.

HOME ECONOMICS SCHOOL MAKES AUSPICIOUS START.—The first school of home economics to be established by any division of the National Electric Light Association was held recently at the Oklahoma A. & M. College, Stillwater, under direction of Dean Nora A. Talbot, with the co-operation of Miss Florence D. Schertz and Mrs. Bess Brooks. National and geographic division officials were present, and the school was declared an unqualified success.

RATES SLASHED IN SIXTEEN IOWA CITIES.—Reductions of 20 per cent, with a maximum charge of 10 cents a kilowatt-hour and no service charge, became effective on March 1 in sixteen northwestern Iowa communities which recently came into the Iowa Public Service Company electric distribution system. Among the cities benefiting are Cherokee, Clarion, Emmetsburg, Forest City, Eagle Grove, Humboldt, Ida Grove, Le Mars, Rockwell City, Storm Lake and Sac City.

PLANS FOR WORLD ENGINEERING CONGRESS TAKING SHAPE.—The American committee of the World Engineering Congress, appointed by Herbert Hoover as honorary chairman, will meet in Washington on March 22 to formulate plans for the participation of American engineers in the congress, which will be held for the first time in Tokyo in 1929. Tsuneo Matsudaira, Imperial Japanese Ambassador to the United States, will be the host at a dinner.

UTAH ENGINEERING COUNCIL COMMITTEE REPORTS ON BOULDER DAM.—Passage of the Swing-Johnson bill, or comparable legislation, is the most effective present means of so binding California to the upper states that any rights acquired in California will be subject to the Santa Fe compact. This is one of the conclusions the special committee representing the Engineering Council of Utah and another committee appointed by the president of the Utah Bar Association, engaged for six months in a study of the Colorado River problem, present in

a report recently released. "The states should own and control the public waters, provision should be made for developments on the river eventually to come under state control, and Utah should become a party to the Santa Fe compact regardless of the number of states ratifying," the report says.

GEORGIA POWER REDUCES RATE TO LARGE COMMERCIAL CUSTOMERS.—The Georgia Power Company has filed with the Georgia Public Service Commission a reduced rate applicable to its large commercial customers. It is a combined light and power rate embodying a service charge plus a kilowatt-hour charge and permitting the use of one totalizing meter. The rate is applicable to those commercial customers whose combined lighting and power demand exceeds 50 kw. and which use power equal to 40 per cent of the total load.

VICTORIA (TEX.) PLANT TO BE TRIPLED IN RATING.—The Central Power & Light Company has adopted plans for the installation at Victoria of a 9,000-hp. turbine and two 723-hp. boilers that will triple the present generating capacity of the plant, increasing it from 4,500 hp. to 13,500 hp. This new source of electrical energy not only will provide Victoria with an ample supply of power for years to come but will be available, through existing transmission lines, to a territory extending from Luling, Eagle Lake and El Campo on the north and east to Port Lavaca, Beeville and Kenedy on the south and west.

OHIO POWER SUBSTATION BEING RAISED TO 45,000 KVA.—Equipment in the Ohio Power Company's substation at Newcomerstown, Ohio, is being tripled at a cost of $330,470. More than 75 men are employed in revamping the station from a 15,000-kva. bank to a 45,000-kva. bank. Five counties—Holmes, Tuscarawas, Guernsey, Coshocton and Harrison—with 2,246 square miles of territory, will be served by the new plant when it is completed in May. As part of the project two new circuits to Cambridge are being built, as well as a new circuit to Coshocton. The station at Newcomerstown is also being rebuilt.

NEW UNIT FOR GRAND RAPIDS, MICH.—Vice-President Charles W. Tippy of the Consumers Power Company announces that the company means to install a 20,000-kw. turbo-generator at the Wealthy Street plant of the company in Grand Rapids. Mr. Tippy explained that the growth of business in Grand Rapids and Muskegon had compelled the company to abandon all thought of water-power development on the Muskegon River since more generating capacity will be needed within a period of twelve months. The program for the Wealthy Street plant contemplates eventually a maximum capacity there of 200,000 kw. At present an addition to the present turbine room will be built, also a boiler house and 250-ft. concrete stack. Two new boilers will supply steam at a pressure of 400 lb. These will be equipped to burn pulverized fuel. The new unit will virtually double the present station capacity.

ANOTHER INTERCONNECTION FOR PENNSYLVANIA. — Work will start within a few days on construction of a 66,000-volt transmission line from Berwick, Pa., through Salem Township, back of Shickshinny, to the Hunlock Creek power plant. The line will connect the Berwick substation of the Pennsylvania Power & Light Company with the plant of the Luzerne County Gas & Electric Company and is one of the first connections to be made in that region between large companies.

SOUTHWESTERN GAS & ELECTRIC PLANS NEW ARKANSAS PLANT.—Construction by the Southwestern Gas & Electric Company of a steam generating plant on Little River, one mille south of Horatio, Ark., to cost $3,000,000 and be completed in two years' time, is announced to begin soon. Electrical energy will be furnished from it to the towns in southwestern Arkansas and eastern Oklahoma whose lighting plants were recently purchased by the Southwestern Gas & Electric Company from the Dierks company. A contract to supply a large cement plant at Foreman is said to make the new generating station necessary.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see ELECTRICAL WORLD for Jan. 7, page 80.]

Maryland Utilities Association—Emerson Hotel, Baltimore, March 23. G. S. Williams, 1005 Continental Bldg., Baltimore.

Southwestern Division, N. E. L. A.—Edgewater Gulf Hotel, Biloxi, Miss., April 3-5. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Nebraska Section, N. E. L. A.—Omaha, April 4 and 5. T. E. Browne, 1527 Sharpe Bldg., Lincoln.

Southeastern Division, N. E. L. A.—Miami, Fla., April 11-14. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

American Institute of Electrical Engineers — Baltimore regional meeting, April 17-19; New Haven regional meeting, May 9-11. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society—Engineering Societies Building, New York, April 25-27. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Bridgeport, Conn., April 26-28. C. G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Jefferson City, April 26-28. F. D. Beardslee, 315 North Twelfth St., St. Louis.

Southwestern Public Service Association—Dallas, Tex., May 2-5. E. N. Willis, 403 Slaughter Bldg., Dallas.

Middle West Division, N. E. L. A.—Hotel Statler, St. Louis, May 9-11. T. A. Browne, 1519 O St., Lincoln, Neb.

American Society of Mechanical Engineers—Pittsburgh, May 14-17. Calvin W. Rice, 29 West 39th St., New York.

National Electric Light Association—Atlantic City, June 4-8. P. S. Clapp, 420 Lexington Ave., New York.

American Association of Engineers—Hotel Hussman, El Paso, Tex., June 4-6. M. E. McIver, 63 E. Adams St., Chicago.

Electrical Supply Jobbers' Association—The Homestead, Hot Springs, Va., June 5-8. E. Donald Tolles, 165 Broadway, New York.

WATERTOWN, N. Y., NOW GENERATES 7,500 HP.—With the placing in service of the third generating unit of the Watertown (N. Y.) municipal hydro-electric plant, 7,500 hp. is available, the waters of the Black River being at a high point, with prospects of a heavy flow during the next three months. The city sells all surplus power to the Northern New York Utilities and is anticipating that the amount received in the next year will be more than $100,000.

DALLAS WIRES ALL UNDERGROUND.—The Dallas Power & Light Company, through C. W. Davis, vice-president and general manager, announces that its underground wire system, which has been in the process of construction for seven years, has been virtually completed. Construction of the underground system, which has followed the best models, has enabled the company to remove almost three hundred poles from the business district, with thousands of wires, which, with the rapid growth of the city, were becoming so numerous as actually to impede progress.

FIRST "SCHOOL OF ELECTRICAL ADVERTISING" IS HELD.—Harrison, N. J., was last week the scene of a four-day "school of electrical advertising" held in the auditorium of the Edison Lamp Works of the General Electric Company, the Westinghouse Lamp Company co-operating. More than two hundred delegates, representing sign manufacturers, power companies and maintenance and accessory men in the East, attended. The gathering was addressed by C. J. Eaton, chairman of the electrical advertising committee of the N.E.L.A., and Earl Whitehorne, commercial editor of the ELECTRICAL WORLD. A second school will be held at Nela Park, Cleveland, on March 19-22.

MORE RATE REDUCTIONS IN KANSAS.—Voluntary rate reductions of from 20 to 25 per cent have been announced for the city of Atchison by the Kansas Power & Light Company, with headquarters in Topeka. New voluntary reduced rates have also gone into effect at Salina, served by the United Power & Light Corporation of Abilene. The former rate, 9 cents for the first 50 kw. and 5 cents for all in excess, has been changed to an 8-cent top rate for the first 30 kw., 6 cents for the next 30 kw.-hr., 5 cents for the next 40 kw.-hr. and 3 cents for all over 100 kw. A revised schedule of residence and commercial lighting rates has been placed in effect at Manhattan as a result of an

agreement between the City Commission and the United Power & Light Corporation. The new rates are about 10 per cent lower than those provided in the franchise that was voted down.

PATROLLING TRANSMISSION LINES BY AIRPLANE.—Addressing the Electric Club of Toronto recently, A. E. Davidson, engineer of the transmission department of the Hydro-Electric Power Commission of Ontario, forecast the use of airplanes to patrol the 230-mile, 220-kv. power line from the Gatineau Power Company's developments on the Gatineau River to Toronto, when construction of the line is completed. Much of the area through which the transmission line will run is rough and inaccessible, and inspection by air would be more rapid and more thorough.

HIGH-POWER LINE TO BE BUILT FROM SAN BERNARDINO TO SEAL BEACH, CAL.—The Southern Sierras Power Company, a subsidiary of the Nevada-California Electric Corporation, has authorized immediate construction of a 110-kv. power line between San Bernardino and Seal Beach, Cal., to cost $750,000. The line will extend over 58 miles and join the company's San Bernardino's substation with the Los Angeles Gas & Electric Company's Seal Beach generating station, giving the Southern Sierras company an outlet for hydro-electric power generated in the High Sierras and making possible in the opposite direction a direct supply of steam-generated power from the Los Angeles plant.

PORTO RICO RAILWAY, LIGHT & POWER GETS FRANCHISE FOR WATER-POWER PLANT.—By the signature of the Governor of Porto Rico to a franchise granted by the Public Service Commission, the Porto Rico Railway, Light & Power Company has gained "authority to utilize the waters and waterfalls of the Hicaco, Cubuy, Prieto, and Sabana Rivers and their tributaries, which form the so-called 'Blanco' River, in Naguabo, Porto Rico, and the so-called Rio Blanco development, and to construct, maintain and operate a hydro-electric plant and the necessary transmission lines." This accomplishes an object for which the company, of which Frederick Krug is general manager, has for some time been striving.

INSULL COMPANY LEASES COMING BLACK RIVER (MO.) POWER.—The Middle West Utilities Company has signed a twenty-year lease on the 30,000-hp. hydro-electric plant to be erected on the Black River, 3 miles southwest of Piedmont, Mo., near Poplar Bluff, by the Black River Hydro-Electric Company. The dam and power plant will cost approximately $4,500,000, according to plans prepared by the W. A. Fuller Company, St. Louis. Construction contracts will be awarded soon after federal and state licenses, now pending, are awarded. The reservoir to be created will be 21 miles long and a quarter of a mile to a mile and a half in width.

Recent Court Decisions

PROPER DIVISION BETWEEN COUNTY AND CITY OF TAX PAID BY HOLDER OF LIGHT AND POWER FRANCHISE. — The District Court of Appeal in California has adjudged proper the division between Tulare County and the city of Dinuba (plaintiff and defendant) of a tax paid by the holder of an electric light and power franchise which caused to inure to the city a sum equal to the tax on the same proportion of gross receipts of the company from consumers in the city which the total value of all pole lines of the company's entire system bore to the total investment of the company. (263 Pac. 249.)*

CONTRIBUTORY NEGLIGENCE OF WORKMAN SPLICING CHARGED WIRES WITHOUT GLOVES HELD FOR JURY.—The Supreme Court of New Jersey has determined, in Brice vs. Eastern New Jersey Power Company, that in the case of a workman who was killed while attempting without gloves to splice a broken fire-alarm wire on a pole supporting also the company's transmission wire the question of contributory negligence was properly submitted to the jury inasmuch as evidence showed that under normal conditions there would have been no current in the electric wire, and since it appeared that the wires came into contact because of the sagging of the electric wire at the distance of one block away (unknown to the workman), which resulted in the insulation wearing off. (139 At. 885.)

DIRECTED VERDICT PROPERLY ELICITED BY INCREDIBLE TESTIMONY.—In Simmons vs. Terrell Electric Light Company a boy testified that a hanging wire, not charged, belonging to the company struck him in the eye so hard when he came into contact with it, while walking with his mother, that he had to pull it out of the eyeball. As there was no claim that the end of the hanging wire was bent and as a physician swore that the boy's eyeball had been pierced from the side nearest the ear, the Court of Civil Appeals of Texas held this testimony incredible and to have justified an instructed verdict for the company. The court found, further, that although the electric company was charged with knowledge of the age, condition and weight of its wires, the strength of their supports and their location as regarded possible injury from limbs of trees, there was no evidence that the company knew of the hanging wire, which had apparently been broken less than an hour, or that it had been negligent in the respects just named. (1 S.W. [2d] 513.)

RIGHT TO RECOVER FOR INJURY FROM ELECTRIC COMPANY FURNISHING EMERGENCY SERVICE ONLY.—In Rhymes vs. Eastern Texas Electric Company, the plaintiff, a workman, sued for damages because of injury received when to repair insulators he went on a pole over which the electric company furnished emergency service to his employer and came into contact with a defective switch. The electric company, claiming a breach of contract by the employer, the Texas Company, filed a cross-bill against the latter, asserting that no emergency warranting Rhymes' presence on the pole existed. The Court of Civil Appeals of Texas affirmed a judgment for the Texas Company, but reversed and remanded one for the plaintiff as against the Eastern Texas Electric Company on the ground of prejudicial errors in charges to the jury. The upper court decreed, however, that the defendant, having installed a jumper to carry energy around the switch and being under contract to keep its appliances in safe condition, could not claim reimbursement from the consumer, even though the latter had not kept a contract to install a switch on its premises and had refused the defendant permission to cut off the current in order to repair switch. (1 S.W. [2d] 688.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

CAN EARNING POWER OF NON-EXISTENT HYDRO PLANT BE EVALUATED?—The Public Service Commission of Oregon is contemplating the advisability of adopting a rule affecting the valuation of utility properties which, if approved, will require the engineering department to appraise water-right holdings and find a valuation of hypothetical electric plants which may be constructed in connection with the water holdings. A serious obstacle in the path of such a program, however, is that neither the regulatory department nor the state engineering body possesses any standard by which a water right can be valued. The Oregon law governing the control of streams does not concern itself with the value of water rights, and the commission engineers express grave doubts as to their ability to pass upon the earning power of an imaginary hydro-electric utility.

UTILITY COMPANY NOT COMPELLED TO OPERATE AT LOSS.—Authority has been granted by the Montana Railroad and Public Service Commission to abandon the traction system in the city of Helena because of a failure to earn a fair return. The commission said that this was the first time since its establishment that the question of granting approval to a complete abandonment and discontinuance of a street-railway system had been presented. The fact that the company had devoted its property to a public use by operating the system on and after the expiration date of the franchise did not, in the opinion of the commission, constitute, under the facts in the record, an irrevocable or absolute dedication of its property to the use of the public. The commission said: "Rather, is its devotion of its property to a public use predicated upon the assumption and condition that the public shall supply sufficient traffic on a reasonable basis to yield a fair return; and when it develops, as it is here shown to have developed, that future operations must be at a loss, then the company has the unquestioned right to discontinue operations and salvage what it can by dismantling the system. To compel petitioner to operate its system at a loss or to give up the salvage value would be to take its property without the just compensation which is a part of due process of law. The rule has been aptly stated by the Supreme Court of Montana in the city of Helena vs. Helena Light & Railway Company, thus: 'It is now well settled beyond controversy that a public utility cannot be compelled to operate its entire business, or a branch of its business, at a loss, in the absence of a statute or contract requiring it to do so.'"

News About Men of the Industry

PROF. R. C. WALLACE of the University of Manitoba has been made chairman of the Manitoba Hydro-Electric Commission.

C. H. DAHL, formerly assistant general manager of the Winnipeg Electric Company, Winnipeg, Man., is now assistant general manager of the company in charge of operation.

KARL B. NORRIS, vice-president and general manager of the Wetmore-Savage Electrical Supply Company, Boston, has been elected president of the Saugus (Mass.) Trust Company.

E. J. MCGARRELL, formerly connected with Stone & Webster, Inc., Boston, has joined the meter department of the Elmira (N. Y.) Water, Light & Railroad Company in the capacity of electric meter inspector. Mr. McGarrell is a graduate of the Worcester Polytechnic Institute.

J. H. SHEARER, president of the Pennsylvania Central Light & Power Company, has been elected a member of the board of directors of the Pennsylvania State Chamber of Commerce. Mr. Shearer has been active in the work of the chamber for several years.

WILLIAM NOYES of Boston, well known in the hydro-electric engineering field, has been appointed operating engineer of the Public Service Company of New Hampshire with headquarters at Manchester. Mr. Noyes will make a complete study of the company's system in regard to water and load conditions.

FRANK A. RUMATZ, Chicago, formerly chief engineer for the Western United Gas & Electric Company, Aurora, Ill., has been made chief engineer for the Tecumseh plant of the Kansas Power & Light Company, with headquarters in Topeka. The Tecumseh plant is the company's chief generating station.

JOHN L. TUDBURY, manager of the Salem Gas Light Company, has been made manager of the Salem Electric Lighting Company as well as general manager of the Beverly Gas & Electric Company. Mr. Tudbury's first connection with the public utility business was with the Lynn Gas & Electric Company. It was in 1911 that he removed to Salem as superintendent of the Salem Gas Light Company.

HERBERT S. HINRICHS, for more than two years field engineer in charge of rural electrical experiments at Larned, Kan., under the auspices of the Kansas Committee on the Relation of Electricity to Agriculture, has become agricultural engineer for the Kansas Power & Light Company, Topeka. Mr. Hinrichs, under whose direction nine electrified farm experiments have been conducted, expects to assume his new position on completion of his present work at Larned about the middle of March. A graduate of Kansas State Agricultural College, Manhattan, he combined with his technical knowledge a thorough understanding of farm problems in Kansas.

Dr. Davis to Head Stevens Institute

Dr. Harvey N. Davis, professor of mechanical engineering at Harvard University and consulting engineer, has been elected president of Stevens Institute of Technology, Hoboken, N. J., succeeding the late Dr. Alexander C. Humphreys. He will assume his new duties Sept. 1. Dr. Davis was born at Providence, R. I., in 1881 and was educated at Brown and Harvard universities, receiving the degree of Ph. D.

H. N. Davis

from the latter in 1906. He was an instructor at Brown in 1901-02 and has been teaching at Harvard since 1904. During 1917-18 he was engineer in the turbine department of the Lynn works of the General Electric Company and in the latter year was occupied in engineering research for the U. S. air service. He has been consulting mechanical engineer of the U. S. Bureau of Mines since 1921. He is a fellow of the American Academy of Arts and Sciences and a member of many other learned and professional societies. Dr. Davis is the author with Prof. L. S. Marks of "Steam Tables and Diagrams" and with Prof. N. Henry Black of "Practical Physics for High Schools." He is also the author of various papers dealing with thermodynamics.

LOUIS LARSEN, for 26 years with the Sundh Electric Company, Newark, N. J., has resigned. Mr. Larsen started with the company when it was originally organized by Mr. Sundh. Since November, 1922, he has been general manager and prior to that time was works manager and chief engineer. During his period of service with the company Mr. Larsen has been granted many patents on control equipment. He represented his company as executive member in the old Electric Power Club and later in the National Electrical Manufacturers' Association. Mr. Larsen as yet has made no announcement regarding his future plans.

WALTER F. HUDSON, director of industrial developments of the Utica Gas & Electric Company, has been appointed director of the industrial bureau of the Utica Chamber of Commerce. Mr. Hudson joined the local utilities as chief engineer in 1920. He is secretary of the Empire State Gas and Electric Association.

WALTER W. KENNEDY, who has been connected with the executive department of the Birmingham Electric Company, Birmingham, Ala., since 1925, has been appointed assistant to J. S. Pevear, vice-president and general manager. Mr. Kennedy was admitted to the bar and practiced law in the firm of Bradley, Baldwin, All & White until he affiliated himself with the Birmingham company.

WILLIAM H. ONKEN, JR., editor of the ELECTRICAL WORLD, has been appointed by Bancroft Gherardi, president of the American Institute of Electrical Engineers, one of the representatives of the Institute at the dedication of the Louvain Memorial at Louvain University, Belgium, July 4, 1928. On that day the new memorial library at Louvain, presented by the Engineering Foundation, together with the clock and the carillon in its tower, which constitutes the memorial to engineers of the United States who gave their lives in the World War, is to be dedicated. Other representatives are Edward Dean Adams, John W. Lieb and Michael I. Pupin.

DR. ANDREW M. SOULE, president of the State College of Agriculture, Athens, Ga., has been named president of the Southern Appalachian Power Conference. The selection of Dr. Soule brings to the head of that body a man who has taken an intense interest in the power and industrial development of the South, devoting his attention especially to the extension of electric power to the rural sections and farms. Through the engineering department of the college, he is carrying on extensive investigations relating to electrification of farms and electrical apparatus and equipment suitable for use on the farm.

L. L. ELLIS, assistant chief construction engineer for the San Joaquin Light & Power Corporation for the past nine years, has resigned to become district sales manager at Fresno for the Yosemite Portland Cement Corporation, Merced, Calif. Mr. Ellis has been identified with construction in the Joaquin Valley since 1901, superintending construction for the Mount Whit-

ney Power Company on the Kaweah River. He built the first concrete power house for the San Joaquin Light & Power Corporation in 1905 and has superintended the building of the Kerckhoff development, the Balch plant and other structures.

B. GREEN has been named superintendent of the Niagara, Lockport & Ontario Power Company at Olean.

C. F. CROWLEY, for seven years Cleveland representative of the Hatfield Electric Company, contracting electrical engineers with offices at Chicago, Indianapolis and Cleveland, was elected vice-president of the company at the annual meeting of its board of directors.

ALLYN B. TUNIS, secretary of the Public Utilities Association of Virginia, has been made director of the Virginia Committee on Public Utility Information, organized early this year, with headquarters at Richmond. Mr. Tunis has had wide experience in newspaper work in Richmond, elsewhere in the South and in New England.

R. B. LILLIE, manager of the Antigo division of the Wisconsin Valley Electric Company, has been appointed manager of the Stevens Point division to succeed M. H. Montross, who has assumed new duties at Wausau. Mr. Lillie has been associated with the Wisconsin Valley utility for the past fifteen years.

H. A. WALSH has been appointed power sales engineer of the Baton Rouge Electric Company, Baton Rouge, La. Mr. Walsh was formerly connected with the Stone & Webster interests at Ponce, P. R., and more recently with the Gulf States Utilities Company at Beaumont, Tex., also a Stone & Webster property.

C. E. BLACKWOOD, superintendent of the Southwest Power Company at Springdale, Ark., has resigned to enter business at Fayetteville, Ark. C. R. REASER, formerly located at Prairie Grove, will succeed Mr. Blackwood. J. C. BLACK, superintendent at Rogers, will have supervision of the Springdale district.

FREDERICK NOLTE, who has been connected with the Wisconsin Valley Electric Company at Antigo, has been appointed manager of that division to succeed R. B. Lillie, at the present time manager at Stevens Point. Mr. Nolte has been affiliated with the Wisconsin Valley company since 1924 and was the purchasing agent previous to his transfer to Antigo.

ROBERT W. ADAMS, formerly manager of the General Electric Company's sales office at Providence, R. I., has been appointed head of the central-station department of New England. He will be responsible for the Northeastern territory, with offices in Boston, Mass. Mr. Adams is a graduate of the electrical engineering course at Worcester Polytechnic Institute, Worcester, Mass., and has been with the General Electric Company since 1908. He was president of the Providence Engineering Society in 1917-18 and is the inventor of the Adams transmission line calculator.

FRANK S. ROOT has joined the power sales engineering staff of the New England Power Company, with headquarters at Worcester, Mass. Mr. Root was for some years in charge of power sales activities for the Fall River (Mass.) Electric Light Company, and until coming to Worcester occupied a similar post in the organization of the Central Hudson Gas & Electric Company. He was active in the New England Association of Central Station Power Engineers from the time of its organization until leaving for New York State.

H. B. HERYFORD has been appointed manager of the San Joaquin division of the Pacific Gas & Electric Company to succeed the late Charles H. Northcutt. A native of California, Mr. Heryford has spent 25 years in the public utility industry. In 1903, starting with the Colusa Gas & Electric Company, he rose to the management of that company in three years. He became manager of the Chico district of the Pacific Gas & Electric Company three years later and in 1921 was appointed to the managership of the West Side division.

DEWITT CLINTON, formerly treasurer of the Worcester Gas Light Company, is now secretary and assistant treasurer of the New England Gas & Electric Association, part of the Associated System. Mr. Clinton has been identified with the public utility industry since 1913, when he resigned as city treasurer and collector of taxes of Worcester to become secretary and treasurer of the Worcester Gas Light Company. Mr. Clinton's new duties include the treasurership of the Cambridge Gas Light Company, the Cambridge Electric Light Company and the Cape & Vineyard Electric Company.

Obituary

C. H. JOHNSON, representative of the National Pole & Treating Company, San Francisco, died March 2. Mr. Johnson had been in ill health for some months.

WATSON F. BLAIR, a director of the Commonwealth Edison Company, Chicago, died of bronchial pneumonia Feb. 7 at the age of 73. He had served on the directorate of the Commonwealth Edison Company for thirteen years. Previous to his retirement from active business some time ago, Mr. Blair was prominent in the Chicago banking field and as a grain commission merchant on the Board of Trade.

JESSE LORENZO HINDS, founder and honorary president of the Crouse-Hinds Company, Syracuse, N. Y., died at his winter home in St. Petersburg, Fla., March 9. Removing to Syracuse from Binghamton, N. Y., where he was born, Mr. Hinds established the Electric Engineering & Supply Company in 1890. He had formerly been associated with business enterprises in Yonkers and Ilion, N. Y.; Alexandria, Va.; Great Bend, Pa., and Dayton, Ohio. The Crouse-Hinds organization was formed in 1897 when Mr. Hinds joined with Huntington B. Crouse of Fairville. Mr. Hinds retired from active duties in 1910.

JAMES W. HARRIS, who has been connected with Alfred Wiseman, Ltd., mechanical and electrical engineers of Birmingham, England, died Jan. 14. After receiving some practical engineering training in England, his native country, Mr. Harris engaged in some work on power plants in India, China, Japan and in America on the Pacific Coast. He served the West Kootenay Power & Light Company, Bonnington Falls, B. C., and then joined the Westinghouse Electric & Manufacturing Company at East Pittsburgh, subsequently returning to Trefford Park, England. Mr. Harris was a member of the American Institute of Electrical Engineers.

CHARLES VERNIER, chief engineer of the Macintosh Cable Company, Ltd., Liverpool, England, died Jan. 9, of pneumonia, following a nervous breakdown. At the time of his death Mr. Vernier held a position of prominence in engineering circles in England. He was in the course of his engineering career affiliated with the Brockie Pell Arc-Lamp Company, the Cork Electric Tramways & Lighting Company and the Newcastle-on-Tyne Electric Supply & Associated Companies. Mr. Vernier was active in the affairs of the Institution of Electrical Engineers, having held many of its important executive offices. He was elected a fellow of the American Institute of Electrical Engineers last June.

WILLIAM J. MEYERS, secretary of the United Electric Light & Power Company, New York, who had been absent from his office for many months owing to a lingering illness, passed away suddenly at his home in Westfield, N. J., Tuesday, March 13. Mr. Meyers, who was in his 59th year, was born in Caledonia, Mich., and was graduated from the Michigan Agricultural College in 1890 and obtained the degree of bachelor of laws from the University of Michigan in 1900. He was statistician of the second district Public Service Commission of New York from 1907 to 1910 and held a like position with the Interstate Commerce Commission until July, 1917. He then became secretary of the United Electric Light & Power Company. He was a very active member of the National Electric Light Association, having served as chairman of an important national committee, and was also a member of the American Gas Association.

Financial and Statistical News

Utility Stocks in New Lead Bond Prices Tend Upward

RECOVERING from the heavy selling movement of two weeks ago which brought market averages down several points in almost all groups, power and light stocks have not only reached previous levels but are taking a new lead. Common stocks of a group of companies representing more than one-third of the industry, in total assets, showed a gain of one point this week over last and of nine points since the beginning of the year. Prominent in the upward movement are Middle West Utilities, Detroit Edison, Commonwealth Edison, etc.

Preferred stocks have remained relatively quiet, with a steady trend toward marginally higher prices. Demand for the better class preferred issues is reported to be consistently good.

Power and light bond prices are also tending upward if less rapidly than a few months ago. The number of new bond issues is considerably below that of last year at this time. The volume of building and construction is lower in most parts of the country than the 1927 program.

Hydro-Electric Power in Norway

Norway has more potential water power than any other European country. According to official statements, about 12,500,000 hp. could be developed continuously. This does not include waterfalls of less than 1,000 hp., which are estimated to amount to about 1,000,000 hp. Through regulation of the flow by damming the lakes, the total could easily be brought as high as 15,000,000 hp., of which about 2,000,000 hp., or 15 per cent, has been developed. Most of the developed power is owned by industrial concerns and utilized for manufacturing purposes, such as the fixation of atmospheric nitrogen and the production of aluminum, ferro-alloys and other substances.

Allis-Chalmers Earns $10.02 on Common

Although sales billed by the Allis-Chalmers Manufacturing Company during 1927 were 8.7 per cent larger than the 1926 total, being $33,352,252, net income carried to surplus decreased from $3,596,891 to $3,182,472, a drop of over 11.5 per cent. Expenses increased almost 10 per cent. Earnings per share, however, showed an increase from $9.48 on common stock in 1926 to $10.02 per share during the calendar year 1927.

	1926	1927
Sales	$30,682,542	$33,352 252
Net	3,596,891	3,182,472

In accordance with a fairly general industrial contraction, unfilled orders at the end of 1927 were $10,013,114, as against $11,634,711 a year previous. The bookings of new business during 1927 totaled $30,651,807, contrasted with $32,170,181 in 1926, which was a 4.7 per cent decrease.

The working capital of the Allis-Chalmers Manufacturing Company at the end of 1927 was $21,241,058, as against $27,289,820 a year previous, the shrinkage being due to retirement of the preferred stock and acquisition of the Pittsburg Transformer Company. Total assets on Dec. 31 last amounted to $62,114,321.

Sales billed and net income for the past two years were as shown in the accompanying table.

Westinghouse Electric Dividend

The payment of the regular dividend was voted by the board of the Westinghouse Electric & Manufacturing Corporation at its meeting deferred from Feb. 29 and held March 14. The next meeting will be March 28.

Middle West Utilities Earns $15.12 on Common Stock

CONTINUING its steady, consistent increase in earnings, maintained over a long period of years, Middle West Utilities shows a gain of 15.7 per cent in parent company earnings, of 11.9 per cent in gross earnings of subsidiaries and of 16.1 per cent in net earnings of subsidiary companies. In keeping with most of the companies, this increase, although attractive, is much smaller than the 1926 record of growth in so far as subsidiary companies are concerned, but the earnings of the parent company showed a larger growth last year. In 1926 parent company earnings expanded 12.1 per cent, subsidiaries' gross 42.7 per cent and subsidiaries' net 55.9 per cent.

Surplus earnings, after payment of preferred and prior lien dividends, interest and administration expenses, were $6,988,401 in the case of the parent company, or the equivalent of $15.12 per share on the 462,079 shares of common stock issued and outstanding Dec. 31 last. This compares with $14.44 per share earned on 435,736 shares a year previous.

Customers served by subsidiaries at the end of 1927 were 1,062,773, as compared with 984,786 in 1926, an increase of 7.9 per cent. The output of electricity was 2,354,241,551 kw.-hr., against 2,054,497,637 the previous year, a gain of 14.6 per cent. Subsidiary companies spent $6,502,343 for maintenance of their properties and appropriated from income $4,120,359 for retirements, the total for depreciation and maintenance being 12.7 per cent of gross operating earnings.

The dividend on the company's common stock was increased from $6 to $7 per share, to be effective with dividend payable May 15, 1928. This payment, in accordance with charter provisions, will entitle 7 per cent cumulative preferred stock of $100 par to a dividend of 7 per cent and 1 per cent additional.

The common stock of the Middle West Utilities is today quoted around 133, which compares with 124 at the beginning of the year, 110 a year ago and 119 two years ago. It has not appreciated in relation to the growth in earnings, nor in relation to the stock increase of many less advantageously situated companies.

Considerable improvement was shown in operating conditions during 1927. Fuel consumption per kilowatt-hour generated decreased by one-third of a pound of coal. Steam generation increased 20.3 per cent during the year and hydro generation 17.3 per cent, making a total increase of 18.9 per cent. In face of this, fuel used increased only slightly over 5 per cent. Cost of residence and commercial service to customers of subsidiaries has dipped sharply below the pre-war level and consequently revenue per kilowatt-hour is now considerably below that level.

Georgia Power Seeks Funds for Improvements

The Georgia Power Company has asked permission of the state public service commission to issue 70,000 additional shares of $6 preferred stock similar to the issue of 30,500 shares recently sold. In submitting a statement to the commission showing that the original issue of stock had been exhausted, Preston S. Arkwright, president of the company, declared that the distribution had been made with the idea of gaining for the company the interest and support of the general public. The sale was made to citizens in 110 Georgia counties, he stated. No person had been allowed to buy more than 25 shares and the sale had been at an average price of $97.52 per share. The present market price of the stock is $105. Employees are allowed $1 per share for

stock distribution. The new issue will be sold at not less than $95 per share without par value, and the proceeds will be distributed over the state in improvements and the rehabilitation of plants already purchased and owned by the power company.

Electrification in Russia

The progress of electrification in Russia is shown by statistics published in a recent issue of the *Economic Review* of the Soviet Union. While the general industrial development of the Union has surpassed by a small margin the pre-war level, the production of electrical energy by regional and local public utility stations is about three times the pre-war figure. The number of electric power installations in industrial enterprises has also greatly increased.

Production of electric energy by public utility stations and the capacity in operation during the past five years were:

Fiscal Year	Kilowatt-Hours	Kilowatts
1922–23	905,000,000	478,000
1923–24	897,000,000	498,185
1924–25	1,132,000,000	538,026
1925–26	1,470,000,000	618,862
1926–27	2,100,000,000	733,635

In 1913 the output was 690,000,000 kw.-hr. and the capacity 328,000 kw.

The program of the State Planning Committee calls for the following output by public utility stations during the next few years:

Fiscal Year	Kilowatt-Hours
1927–28	3,050,000,000
1928–29	4,100,000,000
1929–30	5,550,000,000
1930–31	6,950,000,000

The output of electric energy by all power stations in the U. S. S. R. last year was 4,112,000,000 kw.-hr., an increase of 27.7 per cent over 1925-26. Of this amount, factory power plants produced 1,950,000,000, railway and others the remaining 62,000,000 kw.-hr. The total is expected to increase on the average about 25 per cent during each of the next few years and to attain 10,000,000,000 kw.-hr. in 1930-31.

The capacity of public utility stations in operation last year was divided among 640 local stations with an aggregate capacity of 235,000 kw. and eighteen large urban and regional stations totaling 498,635 kw.

METROPOLITAN EDISON INCREASES COMMON DIVIDEND.—Directors of the Metropolitan Edison Company have declared a quarterly dividend of $2 per share on the common stock, no par value, payable March 24 to holders of record March 15. This places the common stock on an $8 annual dividend basis, compared with $7 per annum previously.

CINCINNATI GAS & ELECTRIC ANNOUNCES REFINANCING PLAN.—A refinancing plan, which calls for the redemption of the outstanding bond issues of the Cincinnati Gas & Electric Company and their replacement with new 5 per cent bonds, has just been decided upon by the directors of the company. Among the issues outstanding are: First mortgage 5 per cent bonds which total $11,469,000; sinking fund, series "B," bonds amounting to $5,818,000 and sinking fund, series "C," bonds totaling $5,401,500. These will be redeemed as of April 1 at their individual call prices, according to an announcement made by Charles D. Jones, president. The better money conditions make possible the replacement of the bonds with other issues at a lower rate of interest, the officials pointed out.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday March 13	Low 1928	High 1928
ABITIBI PWR. & PAPER, com., new — no par	75¾	72	81
Ala. Pwr., $7 com. pf.—no par	115	114	115½
Allis Chalmers Mfg., 6% com.	121½	115½	125
Aluminum Co. of Amer., com.	125½	120	136
Aluminum Co. of Amer., 6% pf.	108	105½	108
Amer. & Foreign Pwr., 7% pf.—no par	108½	105½	108½
Amer. & Foreign Pwr., com.—no par	24	22¾	27¼
Amer. Bosch Magneto, com.—no par	23	15½	23
Amer. Brown Boveri Elec.†	12½	11	18
Amer. Brown Boveri Elec., pf. $7	50½	47	63
Amer. Gas & Elec., 6% pf.—no par	107	106½	109
Amer. Gas & Elec., com. †—no par	141	117½	145
Amer. Lt. & Trac., 6% pf.	115	116	120
Amer. Lt. & Trac., new com.	187½	170	191½
Amer. Pwr. & Lt., 6% pf.	105	104	109½
Amer. Pwr. & Lt., com. †—no par	72½	62½	75
Amer. Pub. Serv., 7% pf.	a100½	99	101
Amer. Pub. Serv., com. †	k 70	70	75
Amer. Pub. Utilities, 7% pfc. pf.	k 96½	90	95
Amer. Pub. Utilities, 7% pr. pf.	100	94	101
Amer. Pub. Utilities, com.	k 60	60	65
Amer. States Sec., A	a 5½	4	5½
Amer. States Sec., B	a 5½	4½	6
Amer. Superpwr., 6% pfc pf.—25	k 30½	28½	30½
Amer. Superpwr., 6% 1st pf.	f103	....	....
Amer.Sup'pwr., Class A†—no par	38½	37	41½
Amer.Sup'pwr., Class B†—no par	41	37½	43
Amer. Wtr. Wks. & Elec., 6% pf.	101½	101½	105
Amer. W.W. & E., com. new—no par	54½	52½	61
Anaconda Copper cap. $3	54½	53½	59½
Appalachian Electric Pwr., 7% pf.	109½	108½	110
Arkansas Pwr. & Lt. 7% pf.	107½	108	109½
Assoc. Gas & Elec., $3.50—50	54	....	....
Assoc. Gas & Elec., pf.—$6—no par	95	96	98½
Assoc. G. & E., Class A, 10—no par.	49	47	51½
BABCOCK & WILCOX, 7% com.	117	....	....
Binghamton L., H. & P., $6 pf.	106	102	105½
Birmingham Elec., pf.—$7—no par.	110½	109½	111
Blackstone Valley G. & E., 6% pf.	k106	106	112
Blackstone Valley Gas & Elec., 10% com.—50	161	132	161
Blaw-Knox, com.†	k104	91	105
Brazilian Trac., Lt. & Pwr., $7 com.	f207½	....	....
Brazilian Trac., Lt. & Pwr.,com.,new	f 53	....	....
Broad River Pwr., 7% pf.	106	105	107½
Brooklyn Edison, 8% com.	228½	206½	235½
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	f 26½	....	....
Buffalo, Niagara & East. Pwr. com. $1.20—no par	f 36½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	k 99	98	101
California Ry. & Pwr., 7% pf.	k135	....	....
Carolina Pwr. & Lt., pf.—$7—no par	f110½	109	110½
Central & S. W. Util., $7 pf.—no par	a102½	99½	105½
Central & S. W. Util., pr. in. $7 pf.—no par	a104½	103½	108
Central Ark. Ry. & Lt., 7% pf.	104	105	107
Central Ill. Pub. Serv., $6 pf.	a 99	97½	99½
Central Ind. Pwr., 7% pf.	a 99½	95	99½
Central Maine Power, 6% pf.	96½	96	98
Central Maine Power, 7%	109	109	112
Central Pwr. & Lt., 7% pf.	104½	104½	105½
Central States Elec., 7% pf.	110½	104	112½
Century Elec., 6% com.	b143	140	145
Cincinnati Gas & Elec., 5% com.	g 99	97½	100
Cities Service, $6 pf.—no par	f 99½	87	94½
Cities Service, pf. B—no par	f 9½	8	8½
Cities Service, pf. BB—no par	f 95	80½	86
Cities Service, com.—20	f 58½	40	58½
Cities Service, Bks. Shrs.—10	f 29	22	27
Cities Service Pwr. & Lt., 7% pf.	107½	105½	107½
Cities Service Pwr. & Lt., 6% pf.	99	95½	100
Cleveland Elec. Illg., 6% pf.	112	113	115½
Cleveland Elec. Illg., 10% com.	390	350	410
Columbia Gas & Elec., 6% pf.	k108	107½	110½
Columbia G. & E. com. $5—no par.	90½	89½	97½
Columbus Elec. & Pwr., $2 com.—no par.	k 69½	66	71
Columbus Elec. & Pwr., 7% pf.	113	....	....
Columbus Ry., Pwr. & Lt., 7% pf.	108	....	....
Columbus Ry., Pwr. & Lt., 7 % pf. B	107	....	....
Columbus Ry., P.& Lt. com.—no par	115	....	....
Commonwealth Edison, 8% com.	180½	165	189
Commonwealth Pwr., 6% pf.	k102	102	103½
Commonw'th Pwr., $2, com.—no par	68½	62½	70
Conn. Lt. & Pwr., 8% pf.	119	120	123
Conn. Lt. & Pwr., 7% pf.	116	118	121
Cons. Gas of N. Y., pf.	102	101½	102½
Cons. Gas of N. Y., com. $5—no par.	135½	119½	139½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	e111½	110½	113
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e111½	110½	113
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	e111	110½	115
Cons. Gas, Elec. Lt. & Pwr. of Balti., 5% pf.	e101	100½	101½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $3.00—no par.	e 70½	67½	72½
Consolidated Pwr. & Lt., 7% pf.	105	....	....
Consumers Pwr., 6% pf.	105	105½	106½
Consumers Pwr., 6.6% pf.	106	106	107
Continental Gas & Elec., 7% pr. pf.	106½	106½	108½
Contl. G. & E. com. $4.40—no par.	k230	240	265
Crocker Wheeler, com.†	32	24	27
Crocker Wheeler, 7% pf.	90	77	82
DALLAS PWR. & LT., 7% pf.	110½	110	111½
Dayton Pwr. & Lt., 6% pf.	108	108½	109½
Derby Gas & Elec., 7% pf.	98	96	99½
Detroit Edison, 8% com.	181	166½	194½
Dubilier Condenser, com.—no par.	k 3½	2½	3½
Duke Pwr., cap.	k135	130	145
Duquesne Lt., 7% pf.	k116½	115½	116½
EASTERN NEW YORK UTIL., $7 pf.	k110½	111	112½
Eastern New York Util. com.	m 65	....	....
Eastern States Pwr. $7. com.	k 12	12	14½
Eastern States Pwr., pf.	k 97	98	99
East. Tex. Elec., 7% pf.	107	106	109
Edison Elec.of Boston, $12 com.	d257½	252	268
El Paso Elec. 7% pf.	113	110	112½
Elec. Bond & Share, 6% pf.	109½	109½	111½
Elec. Bd. & Sh. Sec., com. $1—no par	f 91	76	94½
Electric Household Util.†	a 21	13½	21
Elec. Investors, 6% pf.—no par.	102½	101	103½
Elec. Investors, com.†—no par.	45½	40½	46½
Elec. Pwr. & Lt., ctfs. pf.	108	106½	110½
Elec. Pwr. & Lt., ctfs., 40% pd.	k126	120½	125½
Elec. Pwr. & Lt., ctfs., com.—no par	36½	28½	38½
Elec. Refrig. cap.†	6½	11½	15½
Elec. Ry. Securities, com.—no par.	13½	....	....
Elec. St. Battery com. $5.25—no par	72½	69	77½
Elmira Wtr., Lt. & R.R., 7% pf.	k106½	104	107
Empire Pwr., pfc.†	k 34	27½	35½
Engr. Pub. Serv. $7. pf.—no par.	k109½	107	110
Engr. Pub. Serv., com.—no par.	35½	33	37½
Eureka Vacuum Cleaner, com. $4—no par.	70½	69	79
FAIRBANKS MORSE, 7% pf.	k108½	104	108½
F.-M., com.—$3—no par.	k 38½	32½	40½
Federal Lt. & Trac.,com $1.40ex.div.	52½	42	55
Federal Lt. & Trac., $6 pf.—no par.	103	98	105
Florida Pwr. & Lt., 7% pf.	107	105	107½
Ft. Worth Pwr. & Lt., 7% pf.	d114½	113	114½
GALVESTON-HOUSTON ELEC. 6% pf.	78	75	78
Galveston-Houston Elec., com.	32½	31	34
General Cable, Cl.A	73	56	73
Gen. Elec. $3 com.—no par.	144½	124	144½
Gen. Elec., special—6%	11½	11½	11½
Gen. Gas & Elec. (Del.) com A $1.50—no par.	42½	35½	43½
Gen. G. & E. (Del.) pf. A.$8—no par	k124	122½	126½
Gen. G. & E. (Del.) pf. A $7—no par.	k112	108½	113½
Gen. G. & E. (Del.) pf. B $7	107½	105½	108
Gen. Pub. Serv., $7 cum. pf., no par.	k117	110	120
Gen. Pub. Serv., com., no par.	19½	16½	20½
General Public Utilities, $7 pf.	98½	98	99
Ga. Lt., Pwr. & Rys., com.	k 58	55	65
Ga. Ry. & Pwr., 8% pf.	m125	....	....
Ga. Ry. & Pwr., 7% pf.	m113½	....	....
Gt. Western Pwr., 7% pf.	h105	....	....
IDAHO PWR., 7% pf.	104½	109	110½
Ill. No. Utilities, 6% pf.	a100	98½	100
Ill. Pwr. & Lt., 7% pf.	104½	103	107
Indianapolis Pwr. & Lt., 6% pf.	104	102	107½
IndianapolisPwr. & Lt., $7 pf.	104	100	105
Ingersoll Rand com.	91	90	94
Int. Combus. Engr., com. $2—no par	53½	45½	55½
Int. Combustion Engr.,7% pf.	104½	103½	105½
Int. Util., Class A—$3.50—no par.	46½	45	51½
Int. Utilities, Class B—no par.	7½	6½	10½
Interstate Pwr., pf.—$7—no par.	101	99	103
Interstate Pub. Serv., 7% pf.	104	103	106
Iowa Ry. & Lt., 7% pf.	k 99	02	103
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	107	105	107
Johns-Manville, com.†—no par.	120½	111½	125
Johns-Manville, 7% pf.	121½	119½	121½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; f Montreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, March 10. lBid price Wednesday, March 14. mLatest quotations available. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday March 13	Low 1928	High 1928
KANSAS CITY PWR. & LT. pf. $7	k116¼	115	116¼
Kansas Gas & Elec., 7% pf.	l109¾	107	109
Kentucky Hydro-Elec., 7% pf.	a104¼	....	....
Kentucky Sec., 6% pf.	92	94	98
Kentucky Sec., 5% com.	150	140	150
Kentucky Utilities, 6% pf.	k102	100	103
LACLEDE GAS LT., 10% com.	k200	200	260
Lehigh Pwr. Sec., com.—no par.	26	19¾	27¾
Long Island Ltg., 7% pf.	112	110¼	112
Long Island Ltg., 6% pf.	107¼	107	108¼
Long Island Ltg., com.†—no par.	k178	170	185
Los Angeles Gas & Elec., 6% pf.	h108¼	105¼	109¼
Louisville Gas & Elec., cl. A. $1.75	29	28	29¼
MAN. ELEC. SUPPLY, cap. $5—no par.	53¼	50	54¾
Manilla Elec., com.†—no par.	46	46	50
Maytag Mfg.,com.50—no par.	31¾	30	34¼
Memphis P. & L., pf.—$7—no par.	k109	109	111
Metropolitan Ed., pf.—$6—no par.	106½	103	107½
Metropolitan Ed., pf.—$7—no par.	109¼	109	111
Metropolitan Ed., com. $5—no par.	k140	125	155
Middle West Utilities, 7% pf.	a122¼	116¼	124¼
Middle West Util., 7% pr. lien.	a126	125	129¼
Middle West Util., com. $7—no par	a134¼	123¼	135
Midland Utilities, pr. ln. 6% pf.	a 96¼	94¼	96¼
Midland Utilities, 6% pf. A.	a 91¼	90¼	91¼
Milwaukee Elec. Ry. & Lt., 7% pf.	k103	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k100	98	101¼
Minn. Pwr. & Lt., 7% pf.	l109	107	109
Miss. River Pwr., 6% pf.	108¼	94	109¼
Miss. River Pwr., 3% com.	m 62	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	k107	100	110
Mohawk Hudson Pwr., 2d pf.—$7—no par.	k104	100	109
Mohawk Hudson Pwr., com.—no par	31	29¼	31¼
Montana Pwr., 5% com. ex.div.	163	102¼	167¼
Montreal Pwr., 7¼% com.	f 90	....	....
Mountain States Pwr., 7% pf.	k104	97	105
Mountain States Pwr., com.†	17	....	....
NASSAU & SUFFOLK LTG., 7% pf.	110	98	110¼
National Carbon, 8% pf.	m138¼	138	139
National Elec. Pwr., A†.	a 31¼	27¼	32¼
National Lt., Ht. & Pwr., com.	k 24	20	30
National, Light, Ht. & Pwr., 5% pf.	k 72	70	80
National Pwr. & Lt., pf.—$7—no par	k109¼	108½	111
National Pwr. & Lt., com.†—no par.	25¼	21¾	27¼
National Pub. Serv., 7% pf.	102½	99	103
National Pub. Serv., 7% ptc., pf.	114	108	115
National Pub. Serv., A com. $1.60—no par.	25¼	22	27¼
National Pub. Serv., B com.—no par	k 28	24¼	30
Nebraska Pwr., 7% pf.	l111	110	111¼
Nevada-Calif. Elec., com.	38	33¼	42
New Brunswick Pwr., 4% pf.	k 61	60	70
New Eng. Pub. Serv., pr. ln. pf. $7.	k108¼	98¼	109¼
New Eng. Pub. Serv., pf. $7	k106	95	108
New Orleans Pub. Serv.—7% pf.	108¼	106	110
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	100	91	100
N. Y. Central Elec., 7% pf.	k103	101	104
New York Power & Light 7% pf.	116	....	....
New York Power & Light, 8% pf.	m114	....	....
Newport News & Hampton Ry., Gas & Elec., 5% com.	m109	110	115
Newport News & Hampton Ry., Gas & Elec., 7% pf.	m109	110	115
Niagara Falls Pwr., 7% pf.—25.	28¼	28	28¼
No. Amer., 6% pf.—50.	53¼	53¼	55
No. Amer., com.—10.	61¼	58¾	62¼
No. Amer. Edison, $6 pf.—no par.	k102¼	102¼	105¾
No. Caro. Pub. Serv., pf.—$7—no par	m109	93	105
Northeastern Pwr., com.	20¼	19¼	23
No. N. Y. Utilities, 7% pf.	107	103	109
No. Ohio Pwr., com.—no par.	24¼	18	25¼
No. Ont. Lt. & Pwr., 6% pf.	k 99	94	100
No. Ont. Lt. & Pwr., 4% com.	72	73	78
No. States Pwr. (Del.), 7% pf.	109	108¼	109¼
No. States Pwr. (Del.), 8% com.	133	123	136¾
No. Texas Elec., 6% pf.	55	45	70
No. Texas Elec., com.	16	5	36
OHIO BRASS, com. B $4—no par.	100	89	100
Ohio Brass, 6% pf.	k107	106	111
Ohio Pwr., 6% pf.	106¼	104	107½
Ohio Pub. Serv., $6 pf.	k102½	95	102
Ohio Pub. Serv., 7% pf.	111½	107	112
Ohio River Edison, 7% pf.	109	106	109½
Oklahoma Gas & Elec., 7% pf.	112½	106	114
PACIFIC Gas & ELEC., 6% pf.	27¼	26¼	28¾
Pacific Gas & Elec., 8% new com.	44¼	43¼	49¼
Pacific Pwr. & Lt., 7% pf.	l109¼	106	109
Penn Cent. Lt. & Pwr., $5 pf.—no par.	c 81	79¼	81
Penn-Ohio Edison, 6% pf. no par.	94½	93¼	96
Penn-Ohio Edison, 7% pf.	107	106¼	109
Penn-Ohio Pwr. & Lt., 7% pf.	109½	99	110
Penn Pwr. & Lt.—$7—no par.	l110¼	109¼	110½
Penn Wtr. & Pwr., $2.50 com., new	e 70	68	72¼
Phila. Co., 5% pf.—50.	c 46	46	48¼
Phila. Co., 6% pf.—50.	54¼	52	54¼
Phila. Co., com.—50.	159	149¼	163
Phila. Elec., 8% com.—25.	c 59	55¼	59
Portland Elec. Pwr., 7% pf.	103½	100	104½
Portland Elec. Pwr., 6% pf.	95	78	96
Portland Elec. Pwr., 6% 2d pf.	87	55	88
Portland Elec. Pwr., com.	51½	42½	52
Potomac Elec. Power, 6% pf.	j111	....	....
Pwr. Sec., pf.—no par.	64½	60½	64¼
Pwr. Sec., com.—no par.	k 12	5	15
Public Serv. of Colorado, 7% pf.	k105	99	103
Pub. Serv. of N. J., 6% pf.	105½	103¾	106½
Pub. Serv. of N. J., 7% pf.	118½	118	120¼
Pub. Serv. of N. J., $2 com.—no par	44	41½	45½
Pub. Serv. of No. Ill., 6% pf.	a111½	110	113½
Pub. Serv. of No. Ill., 7% pf.	a119	119	121
P. S. of No. Ill., com. $8—no par.	a170	159½	180
Pub. Serv. of No. Ill., $8 com.	a172	159¾	180
Pub. Serv. of Okla., 7% pr. ln.	k105	100	107
Pub. Serv. Elec. & Gas, 6% pf.	109½	108	110½
Puget Sound Pwr. & Lt., 7% pf.	111	109	113
Puget Sound Pwr. & Lt., $6 pf.—no par.	98½	92	99½
Puget Sound Pwr. & Lt., com.	48	34¼	50
RADIO CORP. OF AMER., $3.50 pf.—50.	56	54¼	57¾
Radio Corp. of Amer., com.—no par.	160	85¼	160
Rhode Island Public Service, pf. $2—no par.	k 31¼	30¼	31¼
Rochester Gas & Elec. 6% pf. D.	106½	105	106½
Rochester Gas & Elec., 7% pf. B.	107	105	107
Rochester Gas & Elec., 6% pf. C.	105	105¼	106½
SAN JOAQUIN Lt. & Pwr., 7% pr. pf.	k116	110	117¼
St. Joseph Ry., L., H. & P., 5% pf.	k 75	70	75
Servel, Inc.	7½	4¾	7¾
Sierra Pacific Elec., 2% com.	37	29	38¼
Sioux City Gas & Elec., 7% pf.	107	100	108¼
Southeastern Pwr. & Lt., pf.—$7 no par.	l 108½	....	....
Southeastern Pwr. & Lt., pfc. pf.	l 87	....	....
Southeastern Pwr. & Lt., com.—no par.	43¼	40¾	44¼
So. Calif. Edison, 8% pf.	k 45½	38¼	41
So. Calif. Edison, 7% pf.	k 29	27¼	29¼
So. Calif. Edison, 6% pf.	26½	25¾	27¼
So. Calif. Edison, 8% com.	46¾	43¾	47¼
Southern Cities Utilities, 7% pf.	k 79	75	78
Southwestern Lt. & Pwr., A $3.	75	60	80
Southwestern Lt. & Pwr., B.	65	60	65
Southwestern Lt. & Pwr., $6 pf.	91½	88	92½
Southwestern Pwr. & Lt., 7% pf.	k111½	103	113
Standard Gas & Elec., 8% pf.	66½	65	68
Standard Gas & Elec., 7% pr. pf.	112½	108	113
Standard G. & E., com. $3.50	62½	57¾	65
Standard Power & Light, com.	42	29¼	45
Standard Pwr. & Lt., 7% pf.	106½	103¾	106½
Staten Island Edison, pf.—$6—no par.	103	99	103¼
Superheater, $6 com.—no par.	167	162	175
Syracuse Lighting, 7% pf.	k110	103	111
Syracuse Lighting, 8% pf.	k117½	114	119
TAMPA ELEC., com. $2.	k 62½	52	64
Tenn. Elec. Pwr., 6% pf.	103½	92	103
Tenn. Elec. Pwr., 7% pf.	109¼	107	110
Terre Haute, Ind. & East. Trac., 5% pf.	k 10	....	....
Terre Haute, Ind. & East. Trac., com.	k 1	....	3
Tex. Pwr. & Lt., 7% pf.	l114½	113½	115
Tide Water Pwr., 8% pf.	111	108	112
Timken Roller Bear., com.—$4 no par.	122½	112¾	134
Toledo Edison, 7% pf.	109½	102	107
Toledo Edison, 6% pf.	k104	95	105
Toledo Edison, 6% com.	k145	120	150
Tri-City Ry. & Lt., 6% pf.	k100	96	102
UNITED GAS & ELEC., 7% pf.	98	98	103
United Gas & Elec. (N. J.), 5% pf.	75	70	77
United Gas Impr., 8% com.—50.	c118¾	111¼	118¾
United Lt. & Pwr., pf.—$4—no par.	a 57	53	57
United Lt. & Pwr., pf.—$6.50—no par.	a100	95	100
United L. & P., com. A .48—no par.	a 17¼	14	17¼
United L. & P., com. B .48—no par. ex. div.	k 24¼	20	25
Utah Pwr. & Lt., 7% pf.	l 111¼	109½	111¼
Utica Gas & Elec., 7% pf.	105	105	106½
Utica Gas & Elec., 8% com.	k200	215	225
Utilities Pwr. & Lt., 7% pf.	101	98	103
Utilities Pwr. & Lt., com. A $2.	32½	28¼	34½
Utilities Pwr. & Lt., com. B $1—no par.	24¼	18¼	26¼
VERMONT HYDRO-ELEC., 7% pf.	k 98	95	102
Virginia Elec. & Pwr., 7% pf.	k110	108	111
WAGNER ELEC., 7% pf.	101	96¼	102
Wagner Elec., com.—no par.	b 48	37	48
Washington Ry. & Elec., 5% com.	j485	....	....
Washington Ry. & Elec., 7% pf.	j104	....	....
Washington Wtr. Pwr., 8% com.	k227	175	235
West Penn Elec., 7% pf.	113	109½	114¾
West Penn Elec., Cl. A $7.	k109½	106¼	110¾
West Penn Pwr., 7% pf.	115¼	114¼	a116¾
West Penn Pwr., 6% pf.	110¼	109½	113
West Virginia Lt., Ht. & Pwr., 7% pf.	k 95	94	100
Western Pwr., 7% pf.	k102	98	105
Western States Gas & Elec., 7% pf.	100	100	106
Western States Gas & Elec., com.	38	....	....
Westinghouse Elec. & Mfg., 8% com.—50.	105¼	88¼	105½
Weston Elec. Instrument, Cl. A $2—no par.	33	30¼	34¼
Weston Elec. Instrument, com.—no par.	k 13¼	12½	14¼
Wheeling Elec., 6% pf.	k104	95	104
Worthington Pump, 7% pf. A.	k 50	46¼	55
Worthington Pump, 6% B.	k 45	41	49¼
Worthington Pump, com.	29	28	34¼
YALE & TOWNE com. $5—25.	74	72½	75

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, March 10. lBid price Wednesday, March 14. mLatest quotations available. †Dividend rate variable.

New Utility Financing Active

Electric light and power financing during the past week has been unusually active, a total of $41,925,000 having been recorded. Six individual issues contributed to this substantial sum. The largest offering was made by the Metropolitan Edison Company in the form of first mortgage gold bonds, priced at 99½ and interest, to yield about 4.52 per cent, a piece of financing involving a total of $23,000,000. Proceeds will be used to retire $20,545,500 bonds bearing higher rates of interest and for additions and betterments.

First mortgage and refunding gold bonds of the San Antonio Public Service Company were offered to the amount of $7,500,000, the price being 97½ and accrued interest to yield about 5.16 per cent.

The Memphis Power & Light Company made an offering of first and refunding mortgage gold bonds, series C, at 96¼ and accrued interest, to yield about 4.70 per cent.

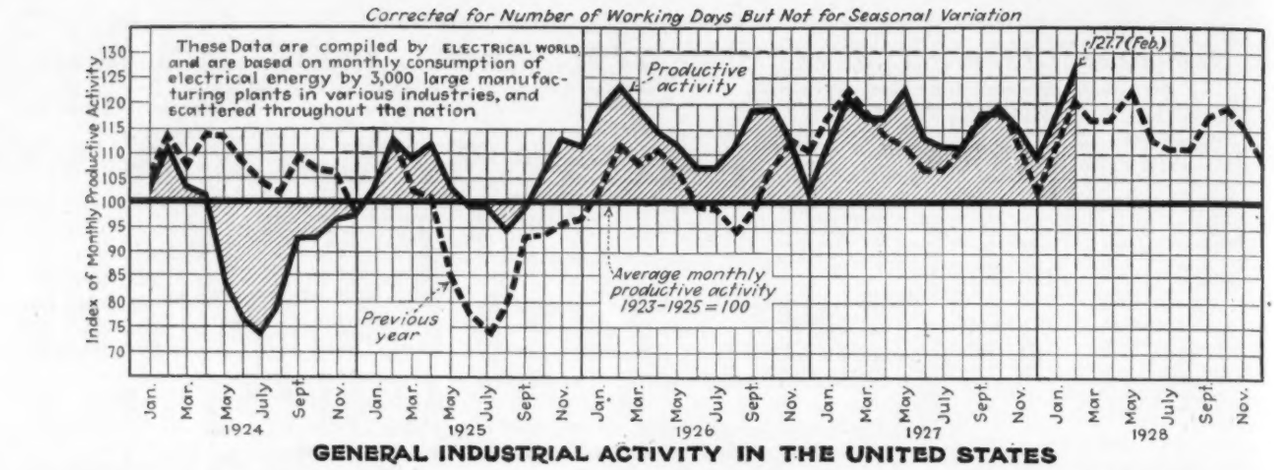
First lien and general mortgage gold bonds of the Utah Power & Light Company were offered to the amount of $5,500,000 at 96¾ and interest, yielding 4.79 per cent. These bonds, dated Feb. 1, 1928, and maturing Feb. 1, 1944, will be secured by a general mortgage on the entire physical property, franchises and rights of the company.

The West Texas Utilities Company issued 25,000 shares of $6 cumulative preferred stock (no par value) at $96 per share and accrued dividend to yield 6.25 per cent.

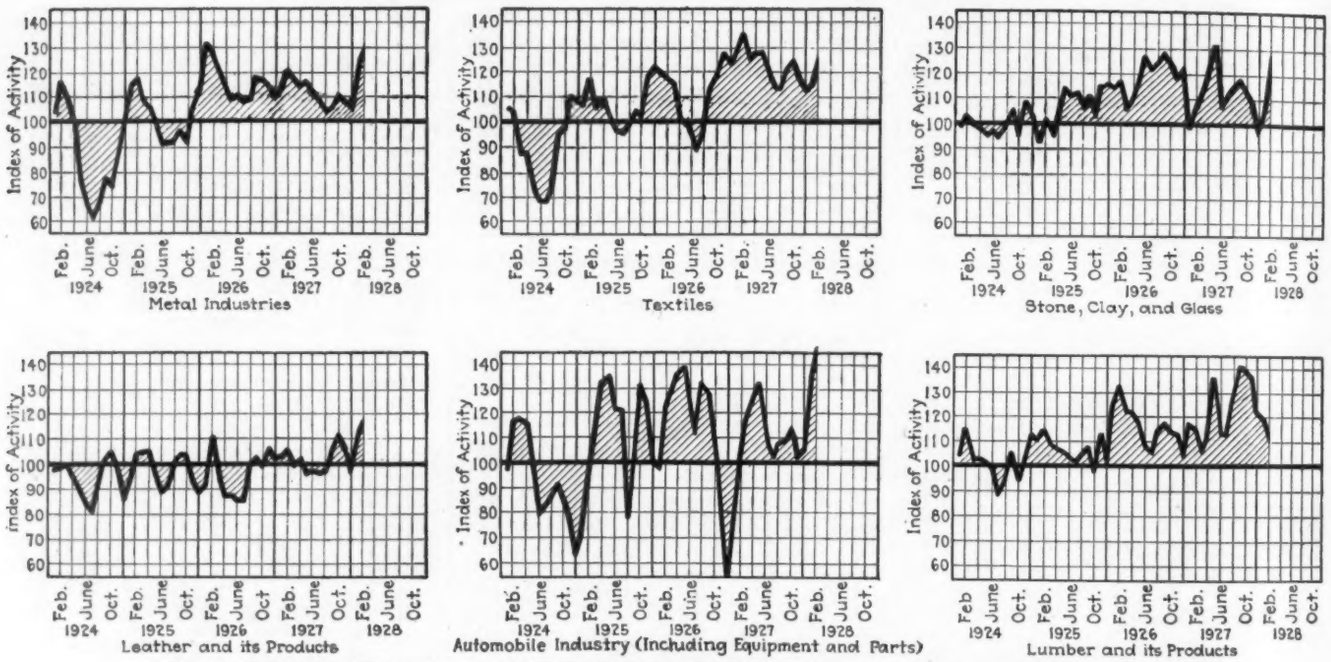
The Orange & Rockland Electric Company issued first mortgage gold bonds at 99½ and accrued interest, to yield over 5 per cent, the offering involving a total of $1,250,000.

An electrical manufacturing company was also represented in the week's new offerings, the Cutler-Hammer Manufacturing Company having issued 75,000 shares of common stock. The price of this stock was $47.50 per share. Proceeds will be used toward the retirement of all of the outstanding preferred stock of the company, which will be called for redemption May 1, 1928.

COMMUNITY POWER & LIGHT CALLS STOCKS.—The board of directors of the Community Power & Light Company has voted to call for redemption all of the company's outstanding first preferred stock, $7 dividend series, and participating preferred stock, $8 dividend series, at the redemption price of $110 per share and dividends.


Corrected for Number of Working Days But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,000 large manufacturing plants in various industries, and scattered throughout the nation
Productive activity
127.7 (Feb.)
Previous year
Average monthly productive activity 1923-1925 = 100
Index of Monthly Productive Activity
Jan. Mar. May July Sept Nov. Jan. Mar. May July Sept. Nov. Jan. Mar. May July Sept. Nov. Jan. Mar May July Sept. Nov.
1924 1925 1926 1927 1928

GENERAL INDUSTRIAL ACTIVITY IN THE UNITED STATES


Index of Activity
Feb. June Oct. Feb. June Oct. Feb. June Oct. Feb. June Oct. Feb. June Oct.
1924 1925 1926 1927 1928
Metal Industries
Textiles
Stone, Clay, and Glass
Leather and its Products
Automobile Industry (Including Equipment and Parts)
Lumber and its Products

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE UNITED STATES

Industrial Production Increased 16 Per Cent

More Than Normal Seasonal Increase in Productive Operations Since the Opening of the Year—All Groups Report Increases Over January

CONSUMPTION of electrical energy by the manufacturing plants of the nation as reported to the ELECTRICAL WORLD indicates that the rate of general industrial production has been materially increased since the opening of the year. The February rate of general production was 16.2 per cent over December and 7.8 per cent over January, a rate of increase comparable with that recorded for the same period in 1927, but materially exceeding that recorded in 1924, 1925 and 1926. It would appear that American industry as a whole has experienced an unusual upward swing since the opening of the year which should do much toward relieving the unemployment reported during December and January.

All sections east of the Rockies have materially increased their rate of production since December. New England, which has been reporting operations at a low ebb for several months, witnessed a February rate of productive activity about 23.7 per cent over December, due very largely to an increase in the operations of the textile mills of over 21 per cent during the two-months period. The manufacturing plants of the Middle Atlantic States reported February operations 15.2 per cent over December, the North Central States 18.4 per cent and the Southern States 5.2 per cent. Productive operations in the Mountain and Pacific States appear to be on about the same level as in December.

Lumber and its products is the only industrial group not recording a materially increased rate of February operations over December, although this group did record increased February operations over January. The greatest increase in the rate of production since the opening of the year has been recorded by the rubber and its products industry, with February operations 41.8 per cent over December, followed by the automobile industry with a 39.7 per cent gain, stone, clay and glass 28.8 per cent, metal working plants 26.2 per cent, rolling mills and steel plants 21.1 per cent, leather and its products 20.7 per cent, chemical and allied products 18.5 per cent, textiles 13.6 per cent, food and kindred products 10.5 per cent, and paper and pulp 1.7 per cent. It is to be expected that materially increased production would be reported during January, February and March, but the rates of increase reported above are in most cases above that to be expected, based upon increases recorded in past years. It now seems probable that several industrial groups will hang up new records of production for the first quarter of the year.

Business News and Market Conditions

Trend of Sound Practice in Industry

Survey Shows That More Companies Reporting a Decrease in Profits Reduced Prices Than Those Which Had an Increased Profit

REDUCTION of manufacturing costs, the purchase of new machinery and an improvement in the quality of the product stand out as the three most important things which manufacturers have done to cope with competition. Following these as a close second, according to a published report of a survey of industry made by the Sherman Corporation of Boston, come product research, process research, market research, increased inventory turnover and a reduction of overhead cost. Of the concerns reporting profit increases 86 per cent said they had reduced the unit cost of manufacture. Concerns reporting profit decreases included only 64 per cent which said they had reduced unit cost to manufacture. Companies in the profit increase group included 63 per cent which said they had reduced their overhead, while 52 per cent of the profit decrease group reported overhead reductions. These figures are significant in showing the relation of profits to the reduction of overhead.

Sixty-one per cent of the concerns reporting profit increases increased volume of sales, while only 27 per cent of the companies showing decreased profits had increased their sales volume. Furthermore only 41 per cent of the profit increase group reduced selling price, while 64 per cent of the decreased profit group had cut selling price. This is regarded as especially significant, as "not getting a fair price" is regarded by many business executives as a key problem in manufacturing today. And the concerns reporting improved profit position reduced expense to sell two to one as compared with the concerns reporting profit decreases. A check of the most pressing current manufacturing problems, divided on a percentage basis, is as follows:

	Per Cent
Sales	35
Production	29
Price	21
Style	4
Quality	4
Administration	4
Financing	3
	100

The trend of sound practice obviously is toward reduction of unit manufacturing cost, maintenance of selling price, reduction of overhead, reduction of sales expense and, as a result of internal economy and efficiency, increase of sales volume. The book containing the report of the survey of industry is entitled "What Is Happening to Business." It also contains excerpts from interviews with representative business executives on the subject of the report.

The outstanding conclusions drawn, with the report as a basis, are given as follows:

1. The product itself is of primary importance. Its quality should not be impaired, but improved and kept to high standards. One way out for manufacturers is to develop merchandise of such quality that price-cutting tendencies can be met by getting into a class of business not dependent primarily on price. It is a day when an honest product is fundamental.

2. In manufacturing there can be no let-up in sound cost reductions. Increasing inventory turnover, getting greater value for the labor dollar, reduction of overhead and reducing time of manufacture are thoroughgoing economy programs which are vitally essential today in all lines of manufacture.

3. Much of the profit decline may be traced back to a hectic scrambling for a larger share of a market of certain fixed size and scope. If there is just so much market available, then cutting prices to get more of that market simply takes away from another manufacturer. Therefore, the necessity of developing new markets.

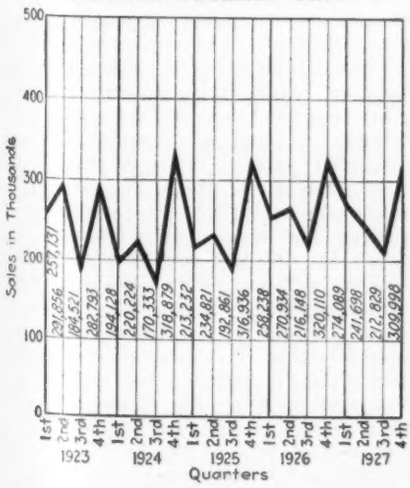
4. Research, a "competition in creation instead of on price," development of new products—these practices will open new markets and allow perhaps a better-balanced production in plants working at 40-50-60 per cent capacity.

5. Price maintenance, wherever possible, is vitally essential. "Price fixing" is out of the question. But the individual manufacturer who has a bottom price and conducts business solidly and courageously, even at a loss of certain volume, with the idea of keeping a semblance of soundness in his price situation, is rendering manufacturing industry a real service and laying the groundwork for improved profit position.

6. The "big pinch" in manufacturing business is selling expenses. Thorough analysis of sales with the purpose of reducing costs to sell is essential.

7. Consolidations and mergers on a basis of economical future operations, especially the reduction of selling and distribution expenses, and not solely on the "window dressing" of past earnings records, are inevitable.

Vacuum-Cleaner Sales

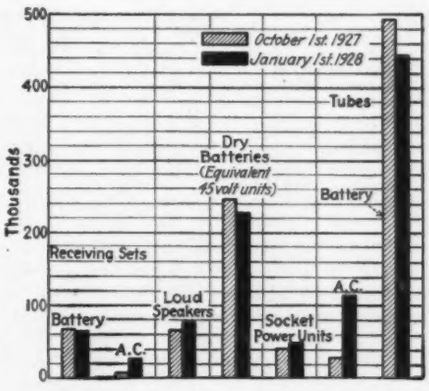


Vacuum-cleaner sales by quarters during 1923, 1924, 1925, 1926 and 1927. (Data supplied by Vacuum Cleaner Manufacturers' Association.)

Building Industry Starts Co-operative Development

Representatives of about 31 of the most important interests in and allied with the building industry launched a national co-operative movement to provide clearing house functions to promote the rehabilitation of the existing homes in America and to create an enlarged and stabilized market for the building industry. The purpose of the movement is said to be to act as a clearing house for the building industry and allied industries or interests and to promote activities such as to advance standards of housing and living; to provide a broader and enlarged market, a more uniform monthly and yearly building activity and employment and a resultant high level of national prosperity; to promote home ownership; to encourage improvements in financing methods and facilities in all communities; to develop, collect and disseminate information regarding markets, and to encourage study and research in all important aspects of housing.

Stocks in Hands of Radio Dealers



Actual returns of approximately 25 per cent of dealers listed

Compiled by the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., with the co-operation and assistance of the radio division, National Electrical Manufacturers' Association.

NOTE.—Radio business during 1927 approximated $500,000,000, according to a statement by R. A. Klock, chairman of the statistical committee, radio division, N.E.M.A.

Market Conditions

STEADY trade is reported in the New England district, with the demand for small motors and industrial equipment at a good level. Negotiations for paper mill equipment are under way and street-lighting projects command attention. In the Eastern district sales are maintaining a good average. The call for prime movers shows an improvement, and a 60,000-kw. turbo-generator was purchased for St. Louis at a cost of $750,000. Orders for switching equipment totaled $310,000 and nearly $1,000,000 worth of wire and cable was bought by a New York utility company.

Healthy business is reported in the Southeast. A central-station company placed a large order for wire and several orders from textile mills are pending. In St. Louis a heavy demand for building materials was reported and an order for $71,000 worth of equipment was placed by a central-station company. Better business is indicated in the Middle West, but there is some apprehension regarding the bituminous coal situation. Industrial activity continues generally favorable. On the Pacific Coast industrial buying continues at a steady rate. The city of Seattle has awarded a contract for the Cedar Falls pipe line at a cost of nearly $250,000. Four carloads of pole line hardware were purchased by power companies.

Copper Demand Light—Price Stable

The demand for copper has been light from domestic as well as foreign buyers. February copper statistics show heavy shipments during February. Lead is in normal demand after the heavy buying of last week. The zinc market continues to advance. A decrease in the price of tin attracted consumer buying.

NEW YORK METAL MARKET PRICES

	Mar. 7, 1928 Cents per Pound	Mar. 14, 1928 Cents per Pound
Copper, electrolytic	14.125	13.825
Lead, Am. S. & R. price	6	6
Antimony	10¼	10¼
Nickel, ingot	35	35
Zinc spots	5.875	6
Tin, Straits	51¼	50¼
Aluminum, 99 per cent	24.30	24.30

Base copper price March 14, 1928, 15¼ cents.

Buying in New England District at Steady Rate

A steady demand for small motors and industrial equipment continued in the New England district. Small motor sales are well up in volume. Orders for a number of higher ratings from 50 hp. up and one of 600 hp. also is noted. Of interest was an order for a 3,150-kw. converter and increased activity in power control apparatus. Central-station supplies are in spotty demand, but pole line material is moving well. Some of the equipment for a short 33,000-volt line in southern New Hampshire was purchased and included about $10,000 worth of insulators. Negotiations for equipment for paper mills are under way.

Sales of contractors' supplies are more active. A number of motor pumping units were recently ordered and sales of arc-welding equipment are gaining as compared with those of last month. Among the major appliances, refrigerators are prominent, with commercial types rapidly gaining favor. Street lighting projects command attention. The Rhode Island Processing Company's plant recently destroyed by fire at a loss of $200,000 will be rebuilt. Authority for the carrying out of the Boston North Station plan for a large arena, new station and hotel has been granted. The Seth Thomas Clock Company, Thomaston, Conn., plans a four-story addition.

Sales Hold Good Average in Eastern District

Good general demand for standard electrical equipment prevails in the Eastern district. A number of utilities are in the market for spring requirements and sizable commitments have been made. The call for prime movers shows improvement and inquiries indicate some desirable orders in this line at an early date. A central station at St. Louis has placed a contract for a 60,000-kw. generating unit with accessory equipment, to cost approximately $750,000. A utility at Keokuk, Iowa, is expected to place orders for several 2,000-kw. generating sets within a short time. A waterwheel manufacturer at York, Pa., has secured a contract for a unit for municipal service at Stoughton, Wis., the order for generating equipment going to a Minneapolis (Minn.) producer. The outlook for early increase in substation business is favorable. A central station in New Jersey has divided an order for switching equipment among three large manufacturers, the total approximating $310,000. The same interest also has purchased oil circuit breakers and auxiliary apparatus aggregating $100,000. A central station company in New York, in addition to the $320,000 worth of high-tension cable reported purchased last week, has ordered $670,000 worth of high-tension cable, $240,000 worth of rubber insulated cable and $60,000 worth of weatherproof wire and cable.

The call for industrial motors shows a temporary lag, following considerable business in larger-sized units in recent weeks. It is expected that there will be a resumption of the demand from iron and steel mills, paper mills and other active industries at an early date. A washing machine manufacturer in a northern New York city has placed a large order for fractional-horsepower units totaling $60,000.

Business in the Philadelphia district shows improvement. There is a better call for transmission line and substation equipment from utilities and early contracts are looked for. The United Gas Improvement Contracting Company recently placed an order for a 30,000-kw. turbo-generator with the Westinghouse Electric & Manufacturing Company and it will be built at the South Philadelphia works. The unit will be used for an installation at New Braunfels, Tex., and includes condensing apparatus.

Immediate construction operations are as follows: The Port of New York Authority, New York, is asking bids until March 26 for complete electrical equipment for the Elizabeth-Howland Hook bridge. The Skenandoa Rayon Corporation, Utica, N. Y., plans several plant units to cost $2,000,000. The Victor Plaster Company, Rochester, N. Y., plans a gypsum plaster mill at Victor, N. Y. The Corona Corporation, Jersey City, N. J., will build a five-story factory addition to cost $100,000. The Pennsylvania Power & Light Company will make improvements in transmission lines at Wilkes-Barre, Drums, Pa., and vicinity, rebuilding a considerable portion for heavier voltage. The Pennsylvania Water & Power Company, Holtwood, Pa., plans a hydro-electric development at Safe Harbor on the Susquehanna River. The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., is asking bids until March 27 for three electric baking ovens for Newport News and Mare Island navy yards (Schedule 8674).

Healthy Business Reported in the Southeast

The tone of electrical business in the Southeast is healthy and there is a considerable amount of business in prospect. A central-station company ordered 14 miles of bare stranded copper wire, 30,000 lb. of weatherproof copper and 10,000 lb. of bare copper wire. Another interesting power company order was for four 66,000-volt potential transformers and two 66,000-volt oil circuit breakers, while another company purchased creosoted pine poles amounting to $6,500. Orders for control batteries from central-station companies for the first two months of this year have been very good and considerably ahead of those for the same period of last year. Six electric industrial trucks have been placed in the New Orleans territory and one in Atlanta, and an order for 45 street trucks for a laundry company is pending.

A textile mill in Alabama ordered $20,000 worth of motors and transformers and a hosiery mill in Georgia ordered a 125-kva. generator with necessary engine and switchboard

equipment. Bids have been asked for a 2,500-kw. turbine for the U. S. Government penitentiary and the engineering contract has been awarded on a new textile mill for construction in Arkansas. Several textile jobs in North Carolina are in the negotiation stage and will probably be closed this week. Municipalities continue their buying activities.

Construction projects are as follows: The Strowd-Holcombe Cotton Mills Company, Birmingham, Ala., plans an addition to cost $150,000. The Chattahoochie Sand & Gravel Company, Columbus, Ga., plans an electric-operated washing and screening plant to cost $200,000. The Proximity Manufacturing Company, Greensboro, N. C., plans an addition to its textile mill to cost $150,000. The Alabama Power Company, Birmingham, plans a transmission line about 50 miles long from its hydro-electric power development at Martin Dam. The Duke Power Company will build a 100,000-volt steel tower transmission line from the Lake James power plant to points in McDowell County. The Western Carolina Power Company will build a transmission line between Rutherfordton and Marion, N. C., and has acquired a site of 5 acres at Marion for a substation. The Bristol Gas & Electric Company plans a transmission line from Butler to Mountain City, Tenn.

Heavy Demand for Building Materials in St. Louis

Business in the southwestern part of the St. Louis district is keeping up. An order for oil well pumping apparatus amounted to $8,500 and another for switches and circuit breakers amounted to $17,000. A central-station company purchased $71,000 worth of equipment. Small-sized motors and transformers sold in fair volume. A number of large buildings nearing completion has caused a good demand for conduit, wire and other electrical building materials. Manufacturers are figuring on several good-sized jobs.

Construction projects are as follows: Alexandria, La., plans an addition to its municipal power plant to cost $35,000. The Dixie Creamery, Inc., Shreveport, La., plans a new plant at Abbeville, La., to cost $100,000. The United States Cold Storage Company, Kansas City, Mo., plans improvements in cold storage and ice plants to cost $1,000,000. Marshall, Mo., plans extensions in its municipal power plant to cost $80,000. The Black River Hydro-electric Company, St. Louis, Mo., plans a hydro-electric generating plant at Poplar Bluff, Mo., to cost $3,000,000. The Empire Refineries, Inc., Tulsa, Okla., plans an industrial alcohol plant at Ponca City, Okla., to cost $300,000. The Magnolia Petroleum Company will extend its refining plant at Beaumont, Tex., to cost $200,000. The Gulf Coast Shell & Cement Company, Houston, Tex., plans a cement mill at Palacios, Tex., to cost $150,000. Cushing, Okla., St. Joseph, Mo., and Childress, Tex., plan installation of ornamental lighting systems.

Industrial Buying Steady on Pacific Coast

Power company orders on the Pacific Coast have included four carloads of pole line hardware, $50,000 worth of distribution transformers for Tacoma and $3,000 worth of poles for Modesto. The San Joaquin Light & Power Corporation is in the market for 2,500 untreated poles, 7 in., 35 ft., for Fresno delivery, a potential order of close to $20,000. Projected building construction includes a $400,000 bank for Bakersfield, a $300,000 apple storage warehouse for Watsonville, a $600,000 church, a $300,000 marble yard and factory and a $500,000 stock exchange for San Francisco and a $500,000 theater and a $3,000,000 department store for Oakland. Overseas business included a 200-hp. synchronous motor and accessories, valued at $3,500, for a Hawaiian plantation and an electrical dredge for Malaya amounting to $30,000. Other varied industrial orders include two 500-hp. motors with switchboard and accessories amounting to $45,000 for an ice company and a 250-hp. induction motor and special control valued at $6,000 for a Nevada mining company.

Numerous but scattered sales of motors, ranging from 100 hp. down, were made to lumber mills, pulp and paper plants, irrigation and orchards, machine shops and other industrial plants by Seattle jobbers. Big orders for electrical equipment for several proposed pulp and paper mills are still in abeyance. The city of Seattle awarded a contract for the Cedar Falls pipe line for $242,024. The city of Seattle also awarded contracts for 32 indoor type and two outdoor type regulators for $42,129 to the General Electric Company, and called for bids for a fourteen-thousand-dollar switchboard and about $3,000 worth of outdoor type reactors. The Great Northern Power Company, Seattle, is planning an expenditure of $10,000,000 for enlargement of its hydro-electric plant at Gold Bar. Transmission line extensions are planned by the Grays Harbor Railway & Light Company, the Washington Water Power Company and the Puget Sound Power & Light Company in various districts.

Construction projects are as follows: The San Joaquin Light & Power Corporation, Fresno, Calif., plans a substation on Ashlan Avenue to cost $80,000. The Western Oil & Refining Company, Los Angeles, will make extensions in its refining plant at Wilmington to cost $1,000,000. The Western Oxygen Company, Los Angeles, plans a new plant at Sacramento, Calif., to cost $100,000. The United States Indian Irrigation Service, Los Angeles, will receive bids until March 28 for boilers, etc. The Alexander Industries, Inc., plans a new plant at Colorado Springs, Colo., to cost $100,000. The Longview Fibre Company, Longview, Wash., plans a new power plant to cost $150,000. The Great Western Sugar Company, Denver, Colo., contemplates a beet sugar refining plant in the vicinity of Powell, Wyo., to cost $150,000. Los Angeles, Los Banos, Santa Maria and Modesto, Calif., and Pendleton, Ore., plan ornamental lighting systems.

Better Business in View in Middle West

The slight recession in business noticeable during February in the Middle West is apparently halted and better business is in view as indicated by steel mill operations, car loadings, automobile sales and retail trade. There is still a fair amount of unemployment. Some apprehension is felt regarding the bituminous coal situation as a tie-up of operations will undoubtedly affect general business in the coal regions. Industrial activity continues generally favorable with considerable construction work in view. Building activity in the Chicago suburban district increased 8 per cent. Manufacturers of pole line hardware report good business, one manufacturer operating 24 hours per day. Maintenance purchasing is quite large, adding materially to the general volume of business.

Construction projects are as follows: The Arkell Safety Bag Company, New York, plans a new branch plant at Chicago, to cost $100,000. The United Felt Company, Chicago, plans a new mill to cost $150,000. The Illinois Northern Utilities Company plans a steam power plant at DeKalb, Ill. The National Plate Glass Company, Ottawa, Ill., plans an addition to its local plant to cost $175,000. The Solem Machine Company, Rockford, Ill., plans an addition to cost $125,000. Evansville, Ind., is asking bids, until March 29, for generators, steam engines, switchboard and auxiliary equipment. The Major Brothers Packing Company, Mishawaka, Ind., plans a three-story plant to cost $350,000. Hawarden, Iowa, will build an addition to its municipal power station. Anderson, Ind., is taking bids on a 12,500-kva. turbo-generator, condensing equipment and auxiliaries. Charles Brossman is consulting engineer, 1010 Chamber of Commerce, Indianapolis, Ind. Swift & Company, Chicago, plans a meat-packing plant at North Platte, Neb., to cost $150,000. The Beet Growers' Association of North Platte Valley, Scottsbluff, Neb., plans a beet sugar refining plant to cost $115,000. The Northwestern Public Service Company, Aberdeen, S. D., will make extensions in its power plant to cost $250,000. The Lakeshire Cheese Company, Loyal, Wis., plans a plant to cost $100,000. The Houghton County Electric Light Company plans a transmission line from Houghton to Chassell, Mich. The Cleveland Electric Illuminating Company, Cleveland, plans a 58-mile steel tower transmission line to cost $1,800,000.

Activities of the Trade

Cutter Company Now Known as I-T-E Circuit Breaker

The Cutter Electrical & Manufacturing Company of Philadelphia, manufacturer of "I-T-E" circuit breakers and "U-Re-Lites" for 40 years, has changed its name to the I-T-E Circuit Breaker Company. Philip C. Gunion, sales manager, said that the primary reason for changing the name was that the company was constantly being confused with two other electrical manufacturers of similar name, one of which is owned by a competitive organization. There has been no Mr. Cutter connected with the company for more than 25 years. The name of the product, the I-T-E circuit breaker, was used in giving the company a descriptive name that cannot be confused with the name of any other company. The policies, personnel and products of the I-T-E Circuit Breaker Company are identical with those of the old company.

Sundh Electric Appoints New Officers

Following the resignation of Louis Larsen, general manager, the Sundh Electric Company of Newark, N. J., announces the appointment of Edward Quimby as general manager, and H. J. Kaufman as general sales manager. Mr. Kaufman has been with the company for the last eighteen years, serving recently as supervising sales manager with headquarters at Chicago. The company states that no other changes were made in the organization.

Refrigerator Sales Show Promise in 1928

Refrigerator distributors of the General Electric Company at a two-day meeting at Cleveland voiced indications of a very good year for 1928. It was brought out that the barometer of public interest for electric refrigeration had gone up. "Although the country has absorbed other products, so far refrigeration has not been fully exploited," said P. B. Zimmerman, sales manager of the electric refrigeration department, in addressing the distributors. "In 1927 387,000 electric refrigerators were sold and it is estimated that the 1928 production will not be less than 500,000. Only 4.3 per cent of the total number of wired homes in the country are equipped with electric refrigeration. The year 1928 will be a good one for the industry as a whole and especially for the General Electric refrigerator. In every case where distributors are leading the field in their territory, their business volume is in direct relation to activity. This is very significant," Mr. Zimmerman explained. The two-day meeting was called to discuss distribution problems in sections of the country and to exchange ideas on proper organization of dealers.

Three hundred members of the Metropolitan district sales force and General Electric executives from Cleveland and Schenectady also met recently at a breakfast given by Rex Cole, Metropolitan distributor, at the Hotel Commodore, New York. Several men spoke on the growth of electric refrigeration. On Friday of this week a special train carried the guests of Mr. Cole to Schenectady to visit the laboratories and plants of the General Electric Company.

Westinghouse Gets Order for Circuit Breakers

An order for switching equipment has been placed by the United Electric Light & Power Company of New York with the Westinghouse Electric & Manufacturing Company. This contract includes eighteen 5,000-amp., three-phase, horizontally segregated phase oil circuit breakers, disconnecting switches and associated details. The breakers have an interrupting capacity of 1,500,000 kva. at 15,000 volts. This breaker order is a duplicate of a previous one and makes a total of 36 such breakers now on order for the United company. The contract also covers 100 500-amp. automatic network protectors, which will be applied to feed three-phase, four-wire, 120-208-volt secondary networks.

SCHWEITZER & CONRAD, INC., 4421 Ravenswood Avenue, Chicago, manufacturer of high-voltage protective and switching equipment, announces the appointment of J. Leo Scanlon as New York City correspondent with office at Room 492, 50 Church Street.

THE MANSFIELD SHEET & TIN PLATE COMPANY, Mansfield, Ohio, manufacturer of electrical sheets, has consolidated with the Ashtabula Steel Sheet Company, the Waddell Steel Company, the Thomas Steel Company, the Falcon Steel Company and the Empire Steel Company of Cleveland. The new organization will be known as the Empire Steel Corporation. The manufacture of electrical sheets will be continued at Mansfield without change under the direction of W. J. Wooldridge, as heretofore. The Empire Steel Corporation will specialize on enameling furniture, and stove sheets, light grade auto body sheets and its complete line of silicon-alloy electrical sheets.

THE CONDIT ELECTRICAL MANUFACTURING CORPORATION, Boston, manufacturer of circuit breakers and power switchboards, announces the appointment of Harris & Butler, Real Estate Trust Building, Philadelphia, as sales representatives for the eastern Pennsylvania territory, including Delaware and southern New Jersey. The western Pennsylvania region, including West Virginia, Belmont and Jefferson Counties, Ohio, and the southern portion of Columbiana County, in Ohio, has been placed in charge of the E. S. Stickle Company, Union Trust Building, Pittsburg.

THE BELDEN MANUFACTURING COMPANY, 23d Street and Western Avenue, Chicago, manufacturer of insulated wires and cables, announces the removal of its office from 399 Market Street, Newark, N. J., to 39 Cortlandt Street, New York City. S. C. Schenck is Eastern manager.

THE ELECTRO-NITE CARBON COMPANY, 306 North Fourth Street, Philadelphia, manufacturer of carbon brushes, announces that its Michigan office is now in charge of A. G. McMann and is located at 307 Basso Building, 7338 Woodward Avenue, Detroit.

THE ELECTRIC MACHINERY MANUFACTURING COMPANY, Minneapolis, manufacturer of synchronous motors and vertical alternators, announces the appointment of L. Brandenburger, 149 West Second Street, South, Salt Lake City, Utah, as its representative. R. R. Poppleton, Inc., 35 First Street, Portland, Ore., and 2963 First Avenue South, Seattle, Wash., also was appointed representative for Portland and Seattle.

EARLE V. HENNECKE, INC., 247 Park Avenue, New York City, has been organized by E. V. Hennecke, formerly vice-president and general manager of the Moto Meter Company, Inc., Long Island. The company will furnish sales and advertising counsel to manufacturers of automotive, electrical and radio products, and also will act as a sales organization handling the complete distribution throughout the world for several large manufacturers.

THE GRAYBAR ELECTRIC COMPANY, Graybar Building, Lexington Avenue and 43d Street, New York City, announces that J. A. Mayer has been appointed Oklahoma manager, with headquarters at Oklahoma City, and R. W. Conrad has been appointed sales manager at Tulsa.

THE ALLIS-CHALMERS MANUFACTURING COMPANY, Milwaukee, announces the purchase of the Monarch Tractor Corporation of Springfield, Ill., manufacturer of crawler or tank type tractors. The purchase of the Monarch line now marks the entrance of the company into the industrial tractor field. The Monarch line will continue to be built at the Springfield plant.

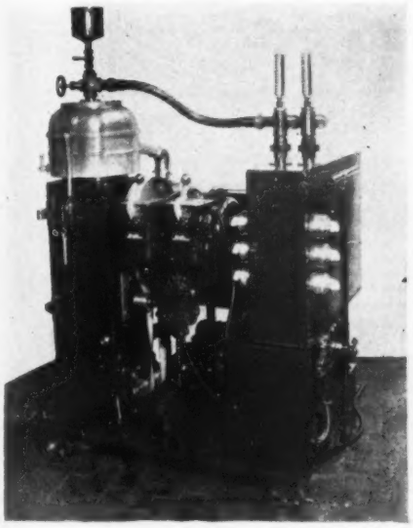
THE GURNEY ELEVATOR COMPANY, INC., 1207 Race Street, Philadelphia, announces that Unit Rasin will have charge of sales in the Philadelphia district.

COMBUSTIONEER, INC., 570 West Randolph Street, Chicago, has been organized by some of the officials formerly interested in the Iron Fireman Corporation of Chicago. The company is producing a new automatic coal-burning device for boilers rated up to 200 hp.

New Equipment Available

Oil Dehydrator and Filter

A new type of centrifugal separator and clarifier has been placed on the market by the "Positive" machinery division of the National Acme Company, Cleveland. The construction of the bowl and cylinders is such that it permits the use of a filter cylinder and filtering mediums, such as felt, linen, paper, etc. The company states that this combined centrifuging and filtering



Portable type hydrator and filter with pump and immersion heaters mounted on a truck

action not only dehydrates the oil but also removes the finest particles of suspended carbon. The separator is furnished in either stationary or portable types. Pumping, heating and cooling equipment are optional, but the company also is offering a portable separator with pumping equipment and immersion heaters mounted on a truck. The portable equipment is shown in the illustration.

Unit Pulverizer

Development made on different sizes of Riley "Atrita" unit pulverizers, made by the Riley Stoker Corporation, Worcester, Mass., are said by the company to give greater reliability, smoother performance and decidedly lower maintenance. The majority of these developments have been in the design and construction of the pulverizing elements. Originally the pulverizing elements consisted of small oval-shaped pegs. The next step in the development was the use of larger round pegs. This increase in the size of the pegs the manufacturer claims increased the life over the original design several times. With the peg type of construction it was necessary to install wearing plates on the rotor to take care of any tendency of the rotor to wear. The present construction consists of small cast segments which are installed on the rotor. The face of these castings acts as the wearing plate. The peg section of the unit casting is many times larger than the 2½-in. pegs previously used. Greater fineness of pulverization also has been obtained, as well as smoother operation.

The greatest feature of the new construction pointed out by the manufacturer is the low maintenance which has resulted from its use. The life of the pulverizing elements has been increased from four to seven times that of the peg construction. The method of supplying hot air to the unit pulverizer has also been redesigned to assure more effective use of hot air, which is particularly necessary when coal with a high moisture content is being used. The coils used in the magnetic separator have been entirely inclosed.

Starter for Small Motors

A new motor starter with a maximum rating of 7½ hp. has been announced by the Westinghouse Electric & Manufacturing Company. The addition of this "Linestarter" now provides the company with a complete line of full voltage starting devices ranging from 1 to 75 hp. The starter comes equipped with hand reset of the thermal overload relay, but if automatic reset is desired the hand reset lever can readily be removed and an automatic reset obtained. The approximate dimensions of the dustproof inclosing cabinet are 8½ in. wide, 12½ in. high and 5¾ in. deep and the approximate shipping weight is 15 lb.

Elevator Control Devices

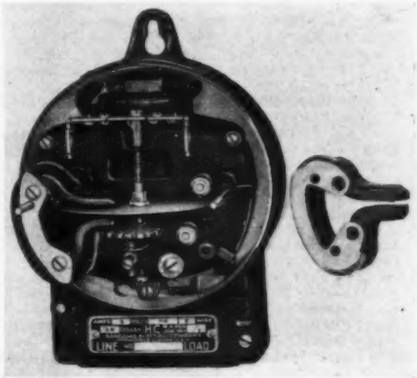
Three new control devices for elevator service, a limit switch, a reverse phase relay and a car switch, have been placed on the market by the General Electric Company. The limit switch is particularly designed for hatch mounting. It is suitable for emergency and overtravel limit protection on high-speed elevators and also may be used for normal limit protection on two-speed elevators, one limit switch being used for each speed. This limit switch is manufactured in three forms, as follows: Single-pole, double-break, normally closed; double-pole, double-break, normally closed, and single-pole, double-break, normally open.

The reverse phase relay is particularly designed for reverse and open-phase protection of elevator motors, although it is applicable to other types of service where the same protection is required. The car switch is designed for use with rheostatic control of either the alternating- or direct-current type and can be used either on single-speed or adjustable-speed motors. Two-point control in either direction of travel is provided.

Watt-Hour Meter

The Sangamo type HC watt-hour meter that is temperature compensated on inductive and non-inductive load has been announced by the Sangamo Electric Company, Springfield, Ill. The company states that the improved performance of the type HC meter has been obtained without any fundamental change in the mechanical or electrical design of the type H, which was brought out in 1914. Such important parts as the upper and lower bearings, the full load and light load adjustments, as well as many others, are interchangeable between the type H and the type HC.

The outstanding changes and improvements incorporated in the type HC are stated by the manufacturer to be: (1) Complete temperature compensation on both inductive and non-



The dowel pins for the permanent magnet serve as thermal-responsive shunts

inductive load. No appreciable variation in accuracy, at any power factor, from 20 deg. F. to 120 deg. F. (2) Straight line accuracy up to 300 per cent load. (3) Decrease in speed of 60-cycle meter so that both 25 to 60-cycle type HC meters have the same constant; this being 1,200 watt seconds for the 5-amp., 110-volt meter. (4) Reversal of direction of rotation (for purposes of standardization). Mechanical improvements also have been made.

Temperature compensation on non-inductive load is accomplished by thermal-responsive magnetic shunts in the permanent magnet system and on inductive load by use of a thermal-responsive magnetic shunt in the pole face of the potential magnet. At present the type HC is available only in capacities up to and including 25 amp., two and three wire, 60-cycle single-phase. Later, a complete line will be available at all frequencies.

FLASHING BEACON.—A new single-color, one-way flashing beacon especially adapted for mounting at bridge entrances, approaches to railroad crossings, dangerous curves in highways and busy intersections has been developed by the General Electric Company. This device may be suspended by means of a hanger or mounted on a pipe. It consists of a standard reflector-type door assembly complete fastened to a casting containing the flashing mechanism.

Electrical Patents

Announced by U. S. Patent Office

(Issued Feb. 21, 1928)

1,660,084. ELECTRICAL CONTROL SYSTEM; E. R. Morton, New York, N. Y. App. filed Nov. 19, 1924. For controlling the frequency of wave generating devices.

1,660,093. INCLOSING SYSTEM FOR ELECTRIC SERVICE APPLIANCES; J. Sachs, Hartford, Conn. App. filed May 6, 1926. Meter service switch.

1,660,147. ELECTROLYTIC GAS-GENERATING SYSTEM; W. G. Allan, Toronto, Ont., Can. App. filed Oct. 1, 1920.

1,660,150. METHOD OF VOLATILIZING AND OXIDIZING MINERALS; B. G. Cobb, Toronto, Ont., Can. App. filed April 6, 1921.

1,660,159. PRODUCTION OF ALLOYS OF THE PLATINUM GROUP; E. Haagn, Hanau-on-the-Main, Germany. App. filed Feb. 9, 1926.

1,660,161. LIGHT-DIMMER RHEOSTAT; E. H. Hansen, Metuchen, N. J. App. filed Nov. 2, 1923.

1,660,180. COMBINED CROSS-CONNECTING SWITCH AND COUPLER FOR ELECTRICAL AND AUXILIARY AIR LINES; H. E. Van Dorn, Chicago, Ill. App. filed April 19, 1922.

1,660,191. CURRENT REGULATING MEANS FOR ELECTRIC INDUCTION FURNACES; C. B. Foley, Fort Wayne, Ind. App. filed March 23, 1922.

1,660,197. ELECTRICAL RELAY; H. O. Holte, deceased, late of Pittsburgh, Pa. Orig. app. filed Sept. 9, 1924. Comprising a movable member arranged to be vibrated when alternating currents are supplied to the relay.

1,660,209. ELECTRIC FURNACE; E. C. Sasnett, Washington, D. C. App. filed Sept. 24, 1919. Crucible induction furnace.

1,660,214. HIGH-TENSION CURRENT TRANSFORMERS; F. Ahrberg, Berlin-Halensee, G. Keinath, Berlin-Charlottenburg, and K. Schrader, Berlin-Halensee, Germany. App. filed Dec. 9, 1924.

1,660,218. MEANS OF HEATING INCLOSURES ELECTRICALLY; C. L. Burgher, New York, N. Y. App. filed Oct. 27, 1925.

1,660,229. STORAGE BATTERY; P. Mallon, Paris, France. App. filed Dec. 16, 1927.

1,660,246. PROCESS OF WELDING CAST IRON; H. V. Wille, Philadelphia, Pa. App. filed April 14, 1921.

1,660,256. AUTOMATIC SWITCH; J. T. Cowley, Syracuse, N. Y. App. filed Jan. 7, 1926. Particularly for use with refrigerating machines for controlling the motor in accordance with the temperature of the refrigerating chamber.

1,660,264. METHOD OF MAKING STORAGE BATTERIES; E. A. Garlock, Baltimore, Md. App. filed July 15, 1924.

1,660,279. SEPARABLE PLUG; S. R. Swenson, South Orange, N. J. App. filed Feb. 20, 1922.

1,660,285. MULTIPLIER; E. F. Weston, Newark, N. J. App. filed Dec. 11, 1925. For a small indicating voltmeter.

1,660,290. ELECTRICAL RECEPTACLE AND ATTACHMENT; R. B. Benjamin, Chicago, Ill. App. filed July 14, 1920.

(Issued Feb. 28, 1928)

Reissue 16,892. MAGNETIC MOTOR; J. G. Ruckelshaus, Newark, N. J. App. filed June 11, 1926. For phonograph turntable.

1,660,317. STAND LAMP CONSTRUCTION; R. B. Benjamin, Chicago, Ill. App. filed June 5, 1924.

1,660,322. VOLTAGE REGULATOR WITH THERMOSTATIC COMPENSATOR; A. F. Brotz, Kohler, Wis. App. filed June 12, 1924.

1,660,390. ELEVATOR CONTROL SWITCH; M. B. McLauthlin, Malden, Mass. App. filed Sept. 17, 1921.

1,660,397. BATTERY CHARGING SYSTEM; H. W. Sayles, Peoria, Ill. App. filed May 15, 1922.

1,660,399. CIRCUIT CONTROLLER; W. C. Stevens, Milwaukee, Wis. App. filed July 26, 1920. For motors.

1,660,400. EXTERIOR OPERATING MECHANISM FOR INCLOSED CIRCUIT CONTROLLING DEVICES; W. C. Stevens, Milwaukee, Wis. App. filed Nov. 8, 1920.

1,660,405. HIGH FREQUENCY MEASURING SYSTEM; H. A. Affel, Maplewood, N. J. App. filed Nov. 21, 1924.

1,660,422. MULTIPLE SOCKET AND PLUG DEVICE; B. P. McKinley, New York, N. Y. App. filed July 18, 1923.

1,660,425. ELECTRIC BUTT WELDING; T. E. Murray, Jr., Brooklyn, N. Y. App. filed Sept. 10, 1924.

1,660,491. METHOD OF WELDING; J. A. Leeper, Wilkinsburg, Pa. App. filed Aug. 31, 1925.

1,660,498. ELECTRIC GROUNDING CONNECTION; W. H. Vibber, New London, Conn. App. filed Feb. 6, 1925. Ground connection for a water pipe.

1,660,499. CONDUIT GROUNDING BUSHING; W. H. Vibber, New London, Conn. App. filed April 3, 1925.

1,660,504. PYROMETER; A. A. Grubb, Mansfield, Ohio. App. filed Aug. 6, 1925.

1,660,518. ELECTRIC PAD; T. H. McComsey, Los Angeles, Calif. App. filed April 6, 1926.

1,660,534. SAFETY LAMP FOR MINES; H. Takata, Tokyo, Japan. App. filed Sept. 15, 1925.

1,660,548. ELECTRICAL FIXTURE; W. B. Crowell, New York, N. Y. App. filed May 3, 1926. Such as push button boxes; means for mounting.

1,660,556. DETACHABLE TERMINAL CONNECTION FOR ELECTRIC STOVE ELEMENTS; J. McC. Gunn, London, Ont., Can. App. filed July 14, 1925.

1,660,562. TROLLEY WIRE HOLDER FOR ELECTRIC TRAMWAYS AND OTHER RAILWAYS; A. Linde, Muckenberg, Nieder-Lausitz, Germany. App. filed Sept. 3, 1926.

1,660,620. BRAKE; G. W. Lautrup, Yonkers, N. Y. App. filed March 18, 1926. Multiple shoe braking mechanism for elevator hoisting machines.

1,660,649, 1,660,650. SEAL; R. D. Mailey, East Orange, N. J. Apps. filed Oct. 16, 1923 and June 16, 1925. In electric apparatus a seal between lead-ins and vitreous walls through which such lead-ins pass comprising fused silver chloride.

1,660,746. MOTOR-TRAFFIC SIGNAL; J. T. Dye, New York, N. Y. App. filed Sept. 14, 1922.

1,660,784. RESISTANCE ELEMENT FOR ELECTRIC IRONS AND THE LIKE; H. Blanksten, Chicago, Ill. App. filed May 8, 1922.

1,660,787. ELECTRIC WATER HEATER; A. Favale, Detroit, Mich. App. filed Dec. 8, 1926.

1,660,794. LIGHT-THERAPY APPLIANCE; W. Hudson, Milton, Wis. App. filed April 11, 1927.

1,660,805. METHOD OF AND APPARATUS FOR ELECTROBRAZING; H. E. Moineau, Marlboro, Mass. App. filed Feb. 24, 1926.

1,660,807. BINDING POST; O. B. Norgren, Chicago, Ill. App. filed May 28, 1925.

1,660,815. POLE CABLE TERMINAL; L. M. Persons, Chicago, Ill. App. filed June 18, 1926.

1,660,827. ELECTRICAL CONNECTER; F. A. Anderson, Milton, Wis. App. filed Dec. 22, 1921.

1,660,828. ELECTRIC FUSE; R. M. Bird, Charlottesville, Va. App. filed Dec. 1, 1922.

1,660,863. CONNECTER SOCKET; O. A. Colby, Irwin, Pa. App. filed Jan. 23, 1923.

1,660,865. SWITCH STRUCTURE; R. C. Deale, Plainfield, N. J. App. filed July 16, 1925. For controlling the operation of planers and similar machine tools.

1,660,869. WAX ELIMINATOR; L. V. Feike and J. R. Payton, Des Moines, Ia. App. filed Feb. 3, 1926. For use with a dentist's mold.

1,660,873. TROLLEY CONDUCTOR SUPPORT; B. Hines, Wilkinsburg, and H. N. Richards, Pittsburgh, Pa. App. filed Feb. 14, 1927.

1,660,874. CIRCUIT INTERRUPTER; C. H. Hodgins, Pittsburgh, Pa. App. filed July 15, 1920. Quick-acting type.

1,660,900. RELAY; R. J. Wensley, Edgewood Park, Pa. App. filed April 16, 1918. For controlling rotary or synchronous converters.

1,660,920. SOLDERING IRON; H. J. Fanger, Oakland, Calif. App. filed Aug. 23, 1926.

1,660,921. RECORDING GALVANOMETER; R. Fischer, Frankfort-on-the-Main, Germany. App. filed May 4, 1921.

1,660,956. COIN OPERATED ROTARY TIME SWITCH; L. C. Eppler, Groton, N. Y. App. filed March 19, 1923.

1,660,965. PROTECTIVE SYSTEM; W. L. Hartzell, Chicago, Ill. App. filed Aug. 25, 1922. For the prevention of abnormal operation of polyphase induction motors and the like.

1,660,979. CURRENT CONTROL DEVICE; W. J. Thayer, Westfield, N. J. App. filed June 30, 1926.

1,661,020, 1,661,021, 1,661,022. ELEVATOR-CONTROL SYSTEM; E. B. Thurston, Toledo, Ohio. Apps. filed Dec. 10, 1921, May 8, 1922, and Sept. 28, 1923.

1,661,026. ELECTRIC FURNACE; A. J. Asch, New York, N. Y. App. filed Feb. 4, 1927. As used in dentistry.

1,661,030. WEED DESTROYER; W. E. Burt, Yuba, Wis. App. filed June 28, 1926.

1,661,054. LOW WATER ALARM FOR BOILERS; F. E. Snyder and J. P. von Giesen, Bronx, N. Y. App. filed Dec. 27, 1926.

New Trade Literature

CHAIN DRIVES. — The Morse Chain Company, Ithaca, N. Y., has issued a catalog covering the Morse silent chain drives. It describes the design and construction of these drives and contains price lists and reference tables. Illustrations showing the various applications of the drives to power transmission requirements in almost every industry are included. The catalog is virtually a handbook on silent chain drives.

SWITCHES AND PUSH BUTTONS.— The Clark Controller Company, Cleveland, is distributing bulletins 105-B and 110, describing and illustrating the Clark "Three C" starting switches for alternating-current motors, and the Clark "Three C" push buttons.

ELECTRIC RANGES AND WATER HEATERS. — A catalog issued by the Walker & Pratt Manufacturing Company, 31 Union Street, Boston, describes and illustrates the various types of "Crawford" electric ranges, water heaters and other "Crawford" electrics. Wiring diagrams and installation suggestions are also included. This catalog is being distributed by the Graybar Electric Company.

SWITCHES.—A series of new catalog sheets to supersede pages now in the company's catalog No. 17 are being distributed by the Trumbull-Vanderpoel Electric Manufacturing Company, Inc., Bantam, Conn., describing and illustrating its current breakers, its main line type "Mason" safety switches and type C inclosed switches.

LINE CONSTRUCTION.—A catalog issued by the Hoosier Engineering Company, 100 West Monroe Street, Chicago, entitled "Cutting the Cost of Transmission Line Construction" covers its overhead and underground line construction. An illustration and description of several typical installations are given.

ARC WELDING SUPPLIES.—A booklet issued by the Lincoln Electric Company, Cleveland, covers its line of welding supplies, including cables, glass, shields, welding electrode, rods, aprons, gloves, brushes, electrode holders, etc.

COUPLINGS AND EDGEWOUND RESISTORS. — Bulletins 103-A and 104-B issued by the Clark Controller Company, Cleveland, describes and illustrate the Clark "Three C" flexible couplings for operation in connection with motors driving reversing mill tables, pumps, compressors, cupola blowers, screwdowns, etc., and the Clark "Three C" edgewound resistors designed to suit all requirements of space or service. The bulletins contain tables of sizes, ratings, etc.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Toulouse, France (No. 30,044), for electric clocks and electric measuring instruments.

An agency is desired in Amsterdam, Netherland (No. 30,043), for household electrical appliances and wiring supplies.

Purchase and agency are desired in Vienna, Austria (No. 30,076), for household electrical appliances.

An agency is desired in Riga, Latvia (No. 30,049), for insulating materials.

Purchase is desired in Andheri, India (No. 30,096), of electric marble-polishing machines.

An agency is desired in Vienna, Austria (No. 39,045), for electric refrigerators.

Purchase is desired in Agua Prieta, Mexico (No. 30,094), of street lighting system equipment.

Purchase is desired in Ciudad Juarez, Mexico (No. 30,075), of complete ten-wire telephone line.

Purchase is desired in Palermo, Italy (No. 30,078), of tungsten lamp filaments.

Pawel Bitschan, Kredytowa 18, Warsaw, Poland, is interested in obtaining catalogs from American electric display sign manufacturers who desire to enter the Polish market.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Growth in All Parts of the Union

THE best guide to the future is a study of the past. During the five years ended with 1927 sales of electrical energy by public utility plants in the United States increased at an average rate of $140,000,000 a year; from about $1,072,000,000 in 1922 to $1,783,000,000 in 1927. The energy output during the same period increased from 43,560,000,000 to 75,116,000,000 kw.-hr., or at a rate close to 6,300,000,000 kw.-hr. a year. On the whole the industry has thus expanded 73 per cent in output and 65 per cent in revenue in half a decade.

Such rapid growth is not unknown in recent business history, but it has in the main been confined to relatively new industries that are presumably in their period of most vigorous expansion, having passed through the initial developmental stage and having still far to go before their market approaches saturation. The electric light and power industry, however, is not a newcomer. Yet its gain since 1922, both in revenue and in energy output, was substantially equal to the whole magnitude in 1919. And 1919 is not so long ago. It may be safely assumed, therefore, that progress in the immediate future at least will continue at the same average rate as heretofore, with the attendant business in electrical goods of all sorts for added residential and industrial applications of power. Add also the necessary replacements of existing materials as they wear out or become obsolete, as well as all the requisite new construction in the power industry itself. The latter is meeting the increasing demands by the net addition of 2,000,000 kva. annually, aside from replacements. Nothing short of a nation-wide catastrophe, or radical interference with normal progress, is likely to affect so well established a trend, except very gradually, and any such catastrophe or interference would necessarily affect with equal severity our entire industrial equilibrium.

Further details are shown by analysis of regional figures. For this purpose the country has been divided into five major sections. Most rapid growth has occurred in the South Central States, particularly in the new industrial Southeast and in the farther Southwest. In that part of the country the output has doubled in the four years since 1923, rising in 1927 to 6,714,000,000 kw.-hr. Revenue, which exceeded $174,000,000 in 1927, fell short of doubling in four years, but more than doubled in five years. In 1927 the energy output exceeded that of 1922 by 138 per cent.

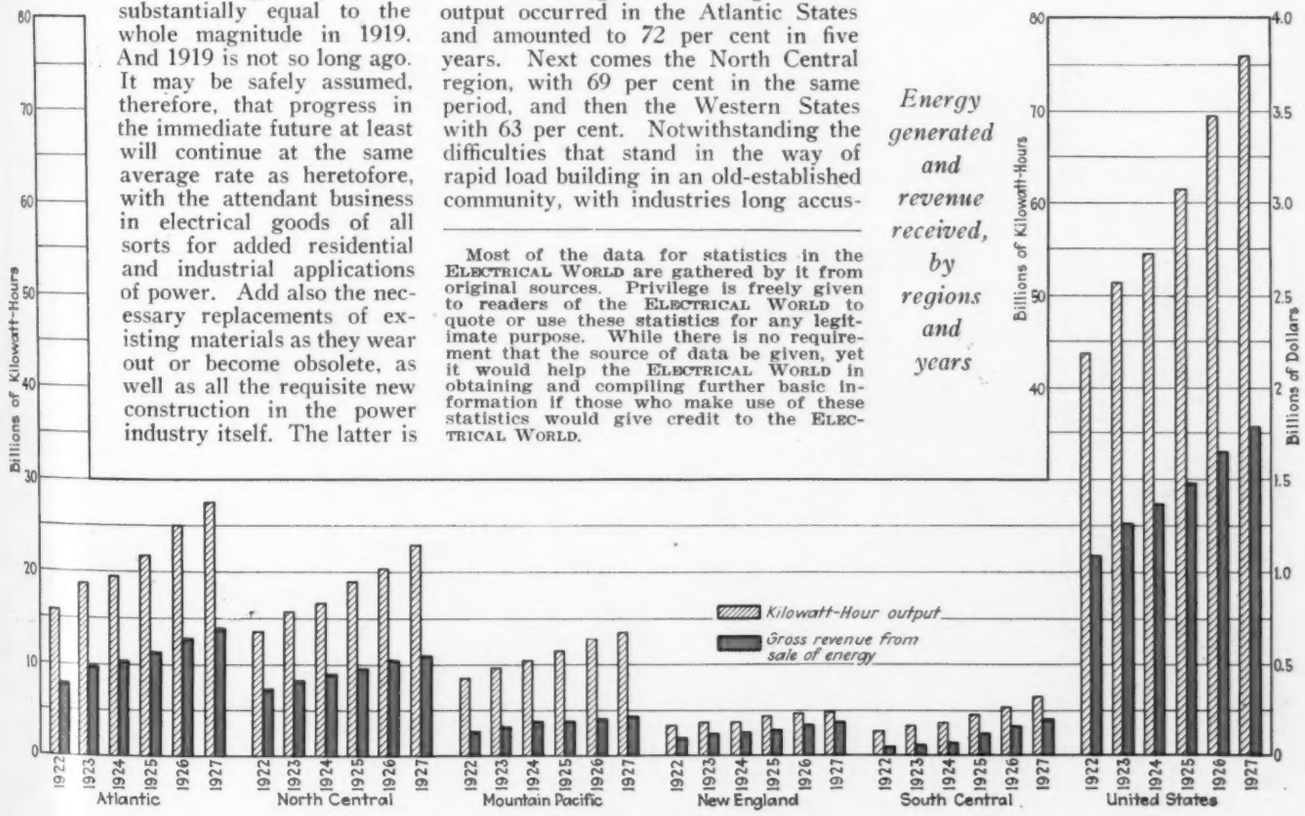
The next highest rate of growth in output occurred in the Atlantic States and amounted to 72 per cent in five years. Next comes the North Central region, with 69 per cent in the same period, and then the Western States with 63 per cent. Notwithstanding the difficulties that stand in the way of rapid load building in an old-established community, with industries long accustomed to the use of their own source of power, the increase in New England was 58 per cent. Were it not overshadowed by the still more rapid development elsewhere in the country this continued advance at 12 per cent annually would be considered remarkable. In many other lines of activity it would be extraordinary. It surely is evidence of constant growth in New England's industrial mechanism as a whole, for electricity constitutes the warp of the industrial fabric. Its increased use signifies more production. And what is here said of New England applies similarly, and in proportionate measure, to the changing electrical consumption elsewhere.

In actual output during 1927 the regional totals, in millions of kilowatt-hours, were: Atlantic, 27,086; North Central, 22,607; Mountain and Pacific, 13,727; South Central, 6,713; New England, 4,983.

In the several regions the revenue figures show the same changes as those for energy generated, except that the movements are generally a little smaller, as might be anticipated in view of the gradual decrease in the price of energy.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Energy generated and revenue received, by regions and years



Atlantic States have maximum output, South Central the fastest growth

Materially Increased Industrial Operations in Southern States

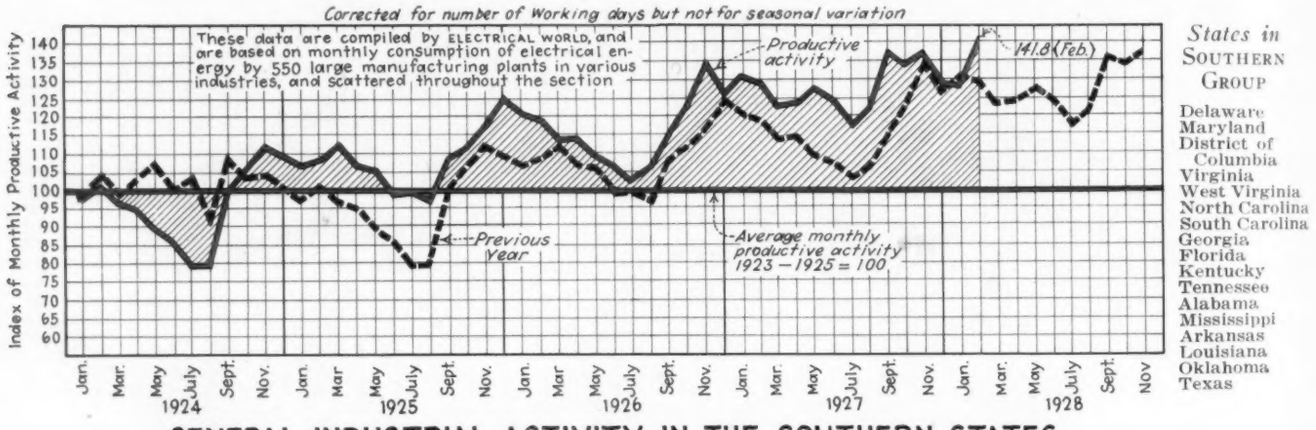
REPORTS on the consumption of electrical energy by the manufacturing plants operating in the Southern States indicate that the first two months of the year witnessed a slightly more than normal increase in the rate of industrial production in this section. February activity was about 11.5 per cent over January and 10.4 per cent over December. Compared with the same month last year the February activities showed an increase of about 9.4 per cent. An upward trend in the rate of production is to be expected at this season of the year, but the rate of increase witnessed from December through February was the greatest recorded in any year since 1923, which is the first year for which data on electrical energy consumption by manufacturing companies was collected.

Indexes of Productive Activity in the Southern States
(All Figures Adjusted for Number of Working Days)

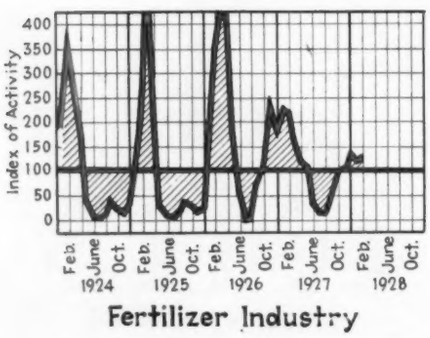
	Feb., 1928	Jan., 1928	Feb., 1927	Average for Full Year 1927	Average for Ful Year, 1926
All industries	141.8	127.2	129.6	127.6	115.9
Fertilizers	121.7	115.0	224.0	109.5	184.3
Metal industries group	128.7	119.1	152.0	125.9	129.5
Stone, clay and glass	204.0	161.8	154.0	156.5	119.7
Textiles	145.7	132.6	149.2	146.0	117.9
Paper and pulp	136.5	135.3	127.5	126.9	118.3
Lumber	136.2	119.0	83.9	101.8	101.0
Food	129.1	125.1	.....	.....	.....

These favorable conditions, however, have not been experienced by all of the basic industries of the Southern States. The textile plants, the most important industry of the section, reported a decrease in operations since December of about 4 per cent, and operations during February about 2.4 per cent under February of last year. This is the first time since 1924 that the February rate of textile activities has been under that of the same month in the year previous. On the other hand, the food, metal working, lumber, paper and pulp and the stone, clay and glass industrial groups all reported materially increased operations over the month of December.

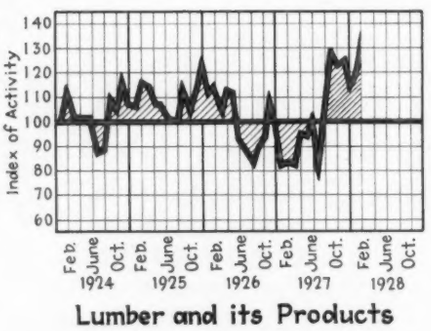
ELECTRICAL WORLD *Barometer of Industrial Activity in the Southern States*



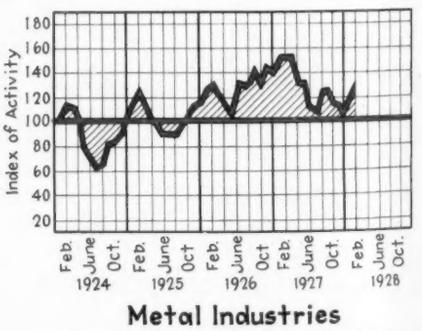
GENERAL INDUSTRIAL ACTIVITY IN THE SOUTHERN STATES



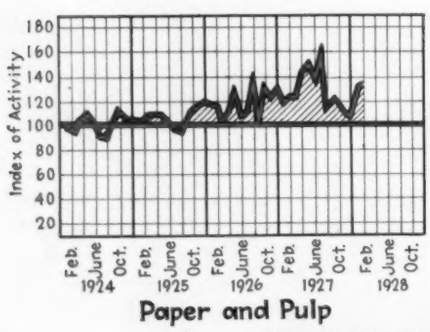
Fertilizer Industry



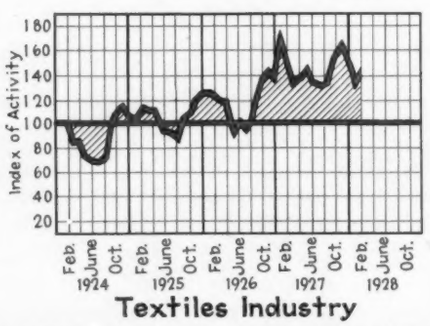
Lumber and its Products



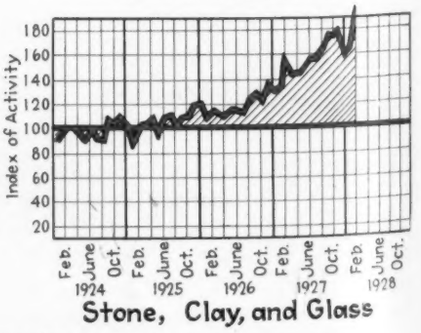
Metal Industries



Paper and Pulp



Textiles Industry



Stone, Clay, and Glass

PRODUCTIVE ACTIVITY IN THE PRIMARY INDUSTRIES OF THE SOUTHERN STATES